WELDING

FEBRUARY 1959

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High Speed Stud Welding On Bridge Beams

THE MAGAZINE OF WELDED FABRICATION

JACKSON for ARC WELDING

Insulated Copper Alloy Holders have greatest strength, hardness and conductivity. Jackson insulators have highest heat and impact resistance. Choose them where greater duty cycles are called for.

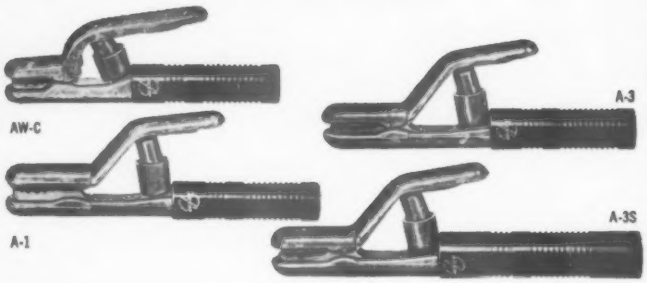
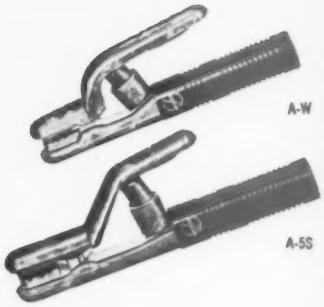


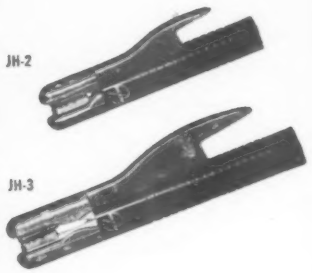
Table shows duty cycles possible with Jackson Insulated Copper Alloy Holders, using electrodes and cables shown.

Holder Class	Model	Electrode	Amps & Cable	Amps & Cable	Duty Cycle
Small	AW-C	7/32"	250—No. 1	300—1/0	50%
Medium	A-1	1/4"	300—1/0	350—2/0	50%
Large	A-3	3/8"	375—2/0	450—3/0	65%
Heavy-Duty	A-3S	3/8"	500—4/0		80%



Featherlight medium class model A-W takes electrodes through 1/4" at 300 amps, weighs 14 oz. Featherlight larger model A-5S has wider tong and wider handle, takes electrodes through 5/16" at 400 amps.

Featherlight Holders have tongs of aluminum alloy, replaceable jaws of high-copper alloy. Excellent all-purpose holders, each within its rated capacity. Cable connection must be made mechanically.



Featherlight and streamlined, small class JH-2 takes electrodes through 5/32" at 200 amps, weighs 9 1/2 oz. Medium class JH-3 takes electrodes through 1/4" at 300 amps.

'Quik-Trik' Cable Connectors 2/0-R and 4/0-R have neoprene rubber insulators with tapered ends to stretch over cable snugly. They lock out moisture and dirt, don't catch against obstructions.

The Jackson
CABLEHITCH

Where welding is done above the level of the machine, Cablehitch suspends the cable near the work area. More cable may be pulled through; it will not slip back.

Cablehitch cuts operator fatigue, increases safety and efficiency, reduces cable wear. In one size to fit welding cables No. 1 through 4/0, gas and air hose 5/16" through 3/8" o.d.

Jackson Ground Clamps give broad metal-to-metal contact. They also fit the hand, go easy on, easy off. Angled socket reduces strain on cable, allows wire fastening for extra support of the cable.

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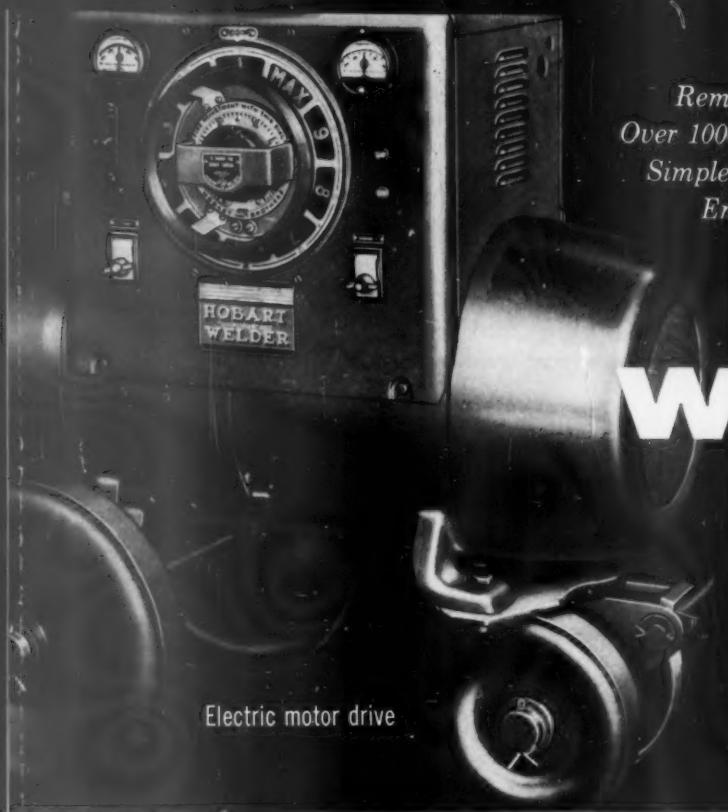

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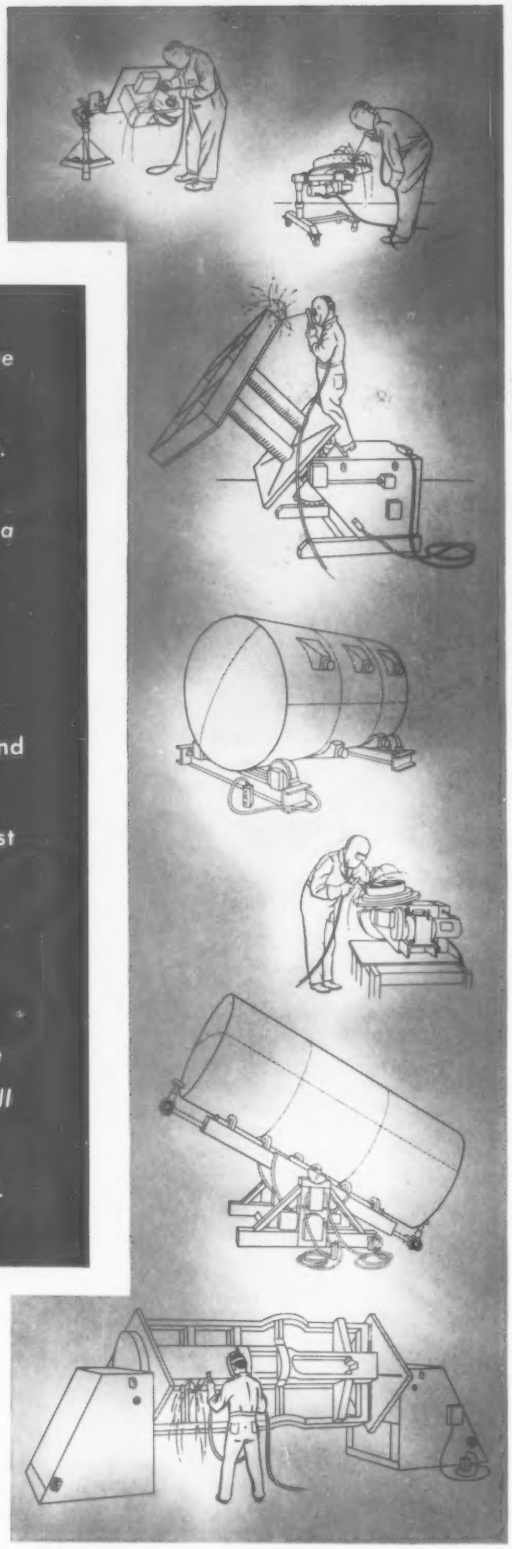

In a board walk the largest item of expense is the lumber; in a splendid violin the least item of expense is the lumber.

In a plain wall the stone is the chief cost; in a piece of classic statuary the cost of the stone is hardly reckoned.

This principle, in a certain degree, applies to the making of a good positioner. We do not pretend that we put more or less material into each Aronson Positioner; but we do put in the best materials, the scientific knowledge and expert skill and the long-continued care which no ordinary positioner contains.

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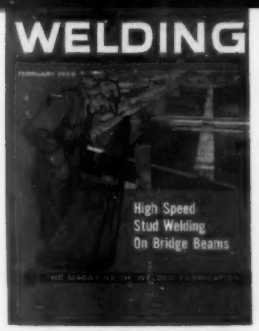
COVER

stud welding makes possible low cost composite bridge construction



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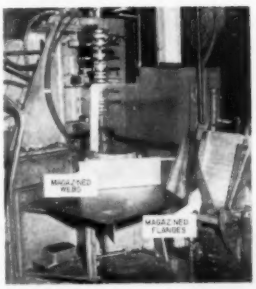

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26 HIGH SPEED STUD WELDING ON BRIDGE BEAMS
Stud welding is the fastest, surest way to join shear connectors to heavy I-beam flanges.

28 AUTOMATIC BRAZING 7 JOINTS IN 4 MINUTES
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INDUSTRY & WELDING
is published monthly by

The INDUSTRIAL PUBLISHING CORPORATION
812 Huron Rd., Cleveland 15, Ohio
IRVING B. HEXTER .....*president*
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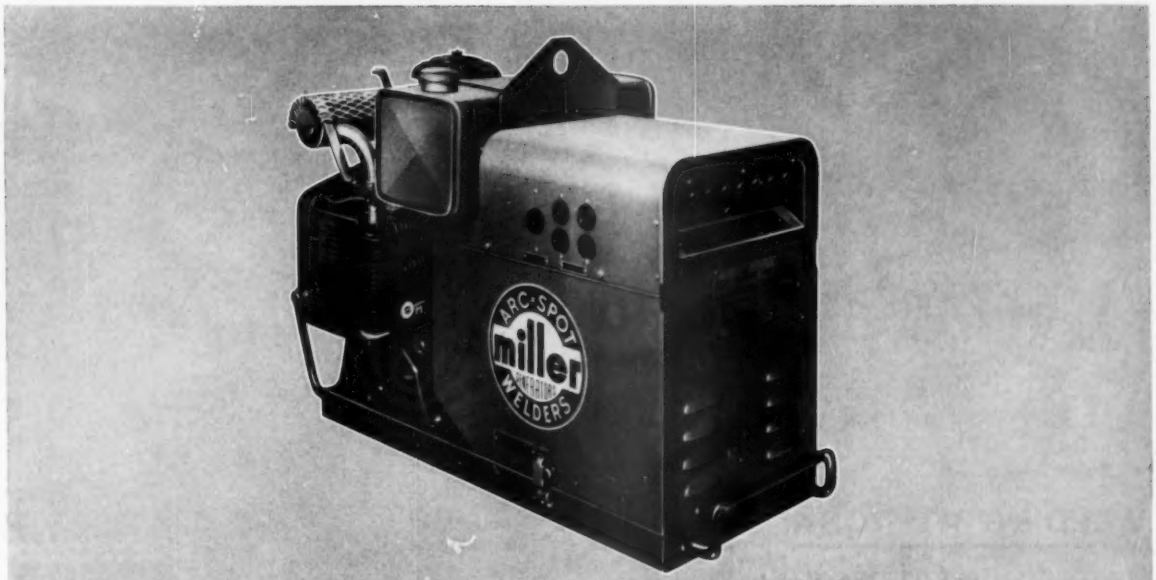
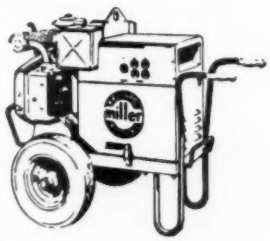
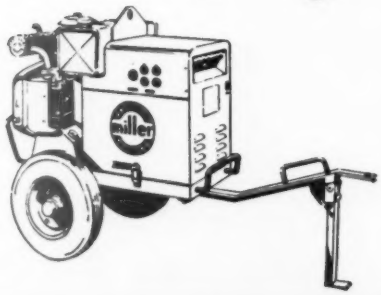
POSTMASTER: Accepted as a Controlled Circulation Publication at Fostoria, Ohio. Send Form 3579 to Room 800, 812 Huron Rd., Cleveland 15, Ohio. Printed in the U.S.A.



The Engine Driven Welder/Power Plant with the 100% DUTY CYCLE





An original Miller design with performance standards, ruggedness and versatility that have made it a top hand from the Texas oil fields to New York dairy farms. Because, whether the AEA-200-L is hub deep in mud welding a derrick brace, or supplying power for lights and milking machines, or answering an emergency call aboard a repair ship. . . . IT DELIVERS. Currently a best seller in the highway construction market, the Miller AEA-200-L is handily the "finest in the field," and here's why:

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- Full 225 ampere output
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- 5 KW, 115-230v ac
- 1 KW, 115v auxiliary dc
- Uses any ac or ac-dc 1/16" to 3/16" electrodes
- Seven station amperage selection with continuous current control

Other Miller welder/power plants for metallic arc and TIG welding to 350 amperes.

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WELDING AT WORK

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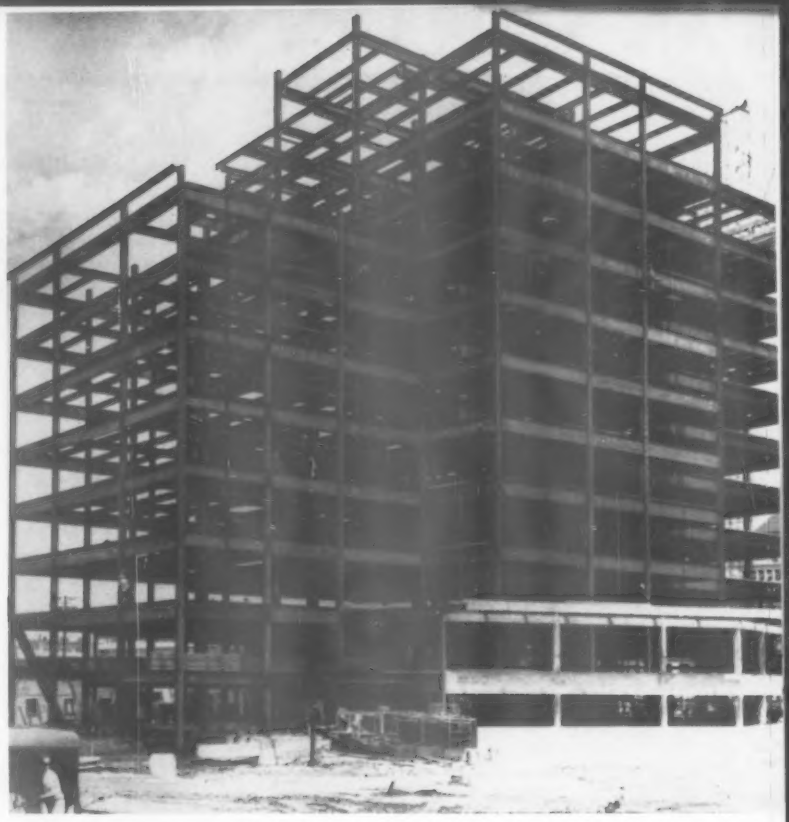


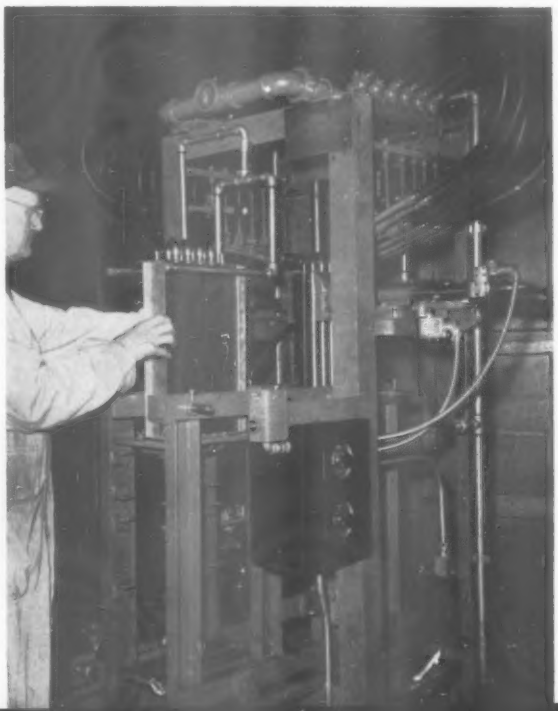
Welding builds Kansas' largest office building

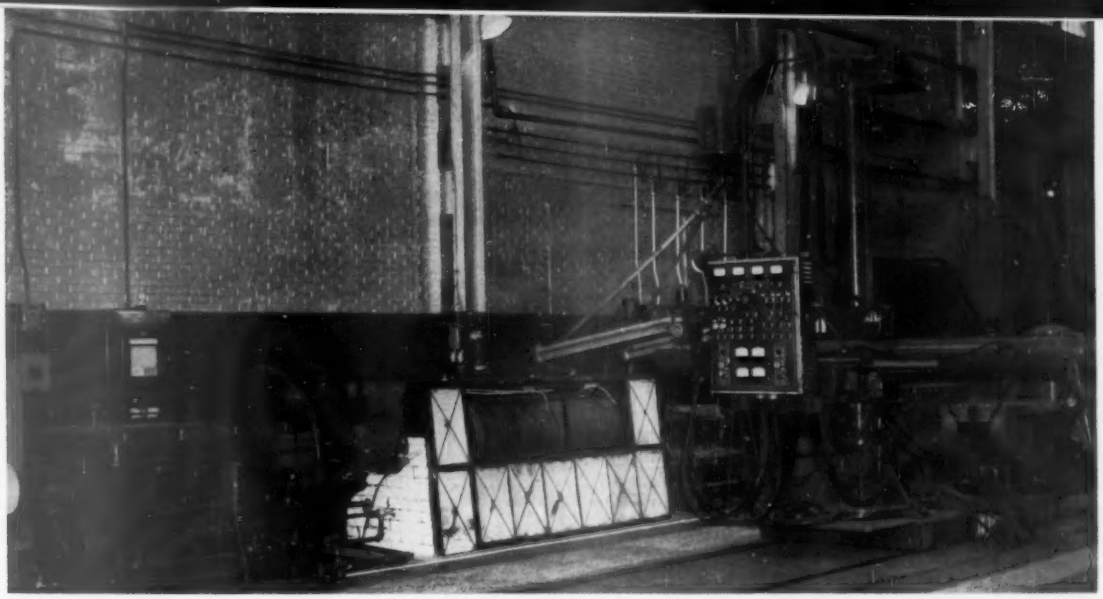
WICHITA, KANSAS: The largest office building in the state, the Sedgwick County court house, is scheduled for completion in December. According to Marcel Lampton of Lampton Welding Supply Co., Inc., more than 10,000 pounds of welding electrodes will have been used to make continuous welds connecting spandrel beams to columns and to weld metal floor deck to floor stringers. More than 3,100 tons of structural steel are being used.

Costing more than $7,500,000, the building is 11 stories high and covers 360,000 square feet.

Brazing unit produces 500 return bend joints an hour

CHICAGO, ILLINOIS: A shuttle-type brazing designed by Gas Appliance Service, Inc., automatically produces 40 to 50 heat and cooling coils an hour. The natural gas/air-fired unit brazes U-shaped return bends on the coils, using pre-placed silver alloy rings. It has two combination loading and cooling stations, one on each side of the heating station, served by a two-position, air-operated carriage, equipped with adjustable support fixtures. Multiple gas burner heads, adjustable to accommodate various coil sizes, are automatically operated as coil is moved into the heating station. Heating is automatically timed. When brazing is done, the coil is moved back into the loading station where an automatic air blast speeds cooling.





Steel mills use automatic surfacing installation

CLEVELAND, OHIO: This automatic installation used by a steel mill to resurface rolls features a Herrick CB 6x6 ram-type manipulator. Two submerged arc automatic welding heads are used with 5-foot nozzle extensions to reach over the large roll which is maintained at a high temperature during welding.

Rolls ranging up to 30-feet long and six-feet in diameter are rotated under the welding heads. The ram machine travels on a carriage and track at speeds ranging from .01 ipm and up. Complete welding control of both heads, either simultaneously or independently, is incorporated in a pendant. Cross adjustment of the two heads is motorized, providing spacing of zero to 48-inches arc to arc.

A completely automatic system feeds, picks up and recirculates shielding flux.

All-welded aluminum boat has speed in rough water

NEW ORLEANS, LOUISIANA: A unique all-welded aluminum personnel boat whose high speed performance could revolutionize water transportation has been unveiled by Higgins, Inc. The unusual hull form of the 52-foot craft makes possible riding qualities and maneuverability previously unobtainable in high speed vessels in other than calm water. Described as having a "polyhedral" bottom, the boat was developed for uses where speed and good sea performance are vital.

The boat was fabricated of aluminum alloy 5456 supplied by Aluminum Company of America, in accordance with Grade B of the Code of Wrought Alloys for Ships' Structures recently proposed by the Society of Naval Architects and Marine Engineers. The highest strength alloy available in the aluminum-magnesium, 5456 has good welding qualities and excellent resistance to sea water corrosion.

About 10-tons of sheet and plate, ranging from 3/16- to 1-inch thickness, were used in the prototype vessel.

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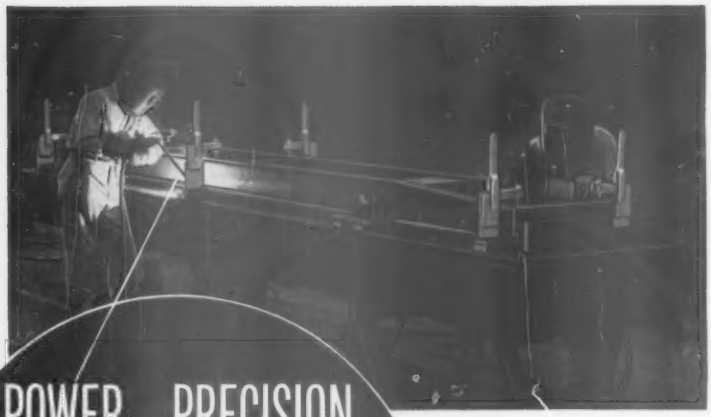

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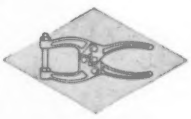
TOGGLE CLAMPS
FOR QUALITY, TOO!

De-Sta-Co "Tiny Toggles" are ¾" high, 2¾" long when closed. Many different bases. U and solid work-holding bars. Ideal for light gauge welded assemblies where space is at a premium.

International Conveyor built this fixture to produce over a hundred 18' wheeled conveyor fixtures on which automobile frames are assembled. The 7" H-beams are brought to bear properly during welding, even sprung to fit, by six De-Sta-Co Model 558 Clamps developing over 2500 lbs. pressure. The completed conveyor line assembly fixtures also employ De-Sta-Co Toggle Clamps.

If your holding problems are at the opposite extreme, there's a group of "Tiny Toggles" only ¾" high but packing 42 lbs. of pressure. This is just an indication of the range you'll find in the De-Sta-Co line of over 130 models, types and sizes for every conceivable fast-action parts holding job. Welders predominantly specify our portable plier clamps. A broad selection of spindle accessories makes it easy to fit any clamp to your job. Along with this versatility, notice the quality features, such as plastic grips, cadmium plating, hardened bushings and serrated pivot pins, as you might expect of the originators of production speed-clamping devices.

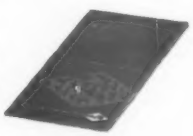
Send for new catalog showing many clamp applications, dimension drawings and mechanical data. Ask for the name of the De-Sta-Co stocking distributor in your area.



Portable Clamps

Angular-Bar Type

Air-Operated Type



De-Sta-Co is widely known for toggle clamps, stampings, precision washers, spacers, shims, shim and feeler stock, blower housings and marine specialties.

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Originators of Production Clamping

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Welding alloy solves cast iron surfacing problem

FLUSHING, NEW YORK: In manufacturing cast iron butterfly valves to specifications of the American Water Works Association, production engineers for the W. S. Rockwell Co. determined that a highly corrosion-resistant alloy should be deposited around the outer circumference of each valve blade. This called for a full, dense deposit free of hard spots and completely machinable. The alloy had to be applied at low amperages to avoid deep and excessive penetration, embrittlement or cracking.

Based on these specifications, the company selected Eutectic Welding Alloy Corporation's Xyron 2-25 (AC-DC) a patented flux coated electrode with high affinity properties for cast iron.

The blades were set up in positioners. Three passes were used on each blade edge; two stringer beads connected by a weave pass.

Complete machinability of the alloy was proven during boring mill operations, in which each overlay was machined down to critical dimensional tolerances. The photograph above shows the shiny contour of the build-up, which close analysis proved free of hard spots, checking or cracking.

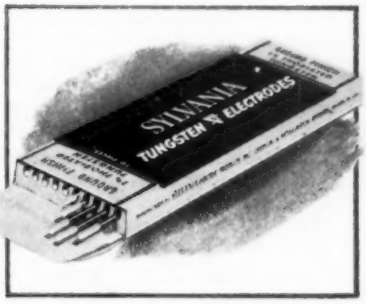
Opinions vary on the preferred finish but–

most welders agree on the preferred electrode

WHETHER your personal choice is in the cleaned finish or the ground finish, Sylvania makes it available to you through your favorite welding supply distributor.

And your choice is available on all four electrode types: Puretung®, Zirtung®, 2% Thoriated, and 1% Thoriated. Whichever finish, in whatever type you choose, it makes good sense to use Sylvania.

Easiest to use—easiest to get—widest range of applications, these are just a few of the important reasons why more welders use Sylvania Tungsten electrodes than any other brand. Ask your Distributor for Sylvania next time you order electrodes.



SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC.
Chemical & Metallurgical Div.
Towanda, Penna.

TUNGSTEN • MOLYBDENUM • CHEMICALS • PHOSPHORS • SEMICONDUCTORS

For More Information Circle No. 61 on Reader Service Card.

Introducing the NEW MODEL 1-A SEVER-ALL Machine... CUTS AT 3 to 6 SECONDS PER SQUARE INCH—ECONOMICALLY

MANY EXTRA FEATURES AT A DELIVERED COST UNDER $500

You get the cut quality and capacity of machines nearly three times as expensive when you use the new Model 1-A SEVER-ALL oscillating dry abrasive cut-off machine. Available from your distributor's stock. Here's why the #1-A SEVER-ALL is ideal for industrial and machine shop operations:

BIG CAPACITY • Up to 2″ square solids, 3½″ O. D. pipe and tubing, 3″ angle iron, and 4″ channels . . . of cold rolled, stainless, and alloyed steel; cast iron; and nonferrous metals. Wheel oscillation, an exclusive feature in this price range, provides this *above-average* capacity.

SPEED • Cuts a 2″ x 2″ hardened steel bar in 16 seconds . . . other shapes and sizes at 3 to 6 seconds per square inch.

QUALITY • Clean, smooth cuts, even on large sections, because wheel oscillation provides cooler cutting.

ECONOMY • In addition to low initial cost, the Model 1-A SEVER-ALL is inexpensive to operate . . . occupies minimum floor space . . . requires little or no set-up time . . . eliminates annealing costs . . . gives more cuts per wheel because of oscillation.

SIMPLICITY • Just two SEVER-ALL cutting wheel specifications will do *all* your SEVER-ALL cutting jobs. A positive, screw-type vise holds all regular shapes, and an adjustable work stop provides speed and accuracy.

ANGLE CUTS • Optional accessory permits cutting angles up to 45° in either direction.

NEW SEVER-ALL AVAILABLE FROM DISTRIBUTORS

Very likely your own distributor already stocks the Model 1-A SEVER-ALL machine and wheels. If not, let us know, and we'll give you the name of your nearest SEVER-ALL distributor. Also, we'll be glad to send you complete details on this new machine. Just ask for **Bulletin DH-106.**

ALLISON-CAMPBELL DIVISION AMERICAN CHAIN & CABLE

925-S. Connecticut Avenue, Bridgeport 2, Conn.

For More Information Circle No. 7 on Reader Service Card.

"Easyarc 14 better all-position rod . . . not as much arc blow in corner welding" —*S. Carolina*

"Airco 387 producing more feet per hour of fillet weld . . . superior handling" —*Virginia*

"Easyarc Iron Powder 308 Stainless . . . gives best appearing stainless deposit ever seen . . . economical" —*Texas*

"Roll hard-facing done with Tempalloy 704 in service for total tonnage of 178,028 tons . . . competitive metal for a tonnage of 121,743 tons" —*Kentucky*

"Easyarc 12 beats all others . . . bead has the smoothest profile . . . grinding eliminated" —*California*

Airco electrodes "WELDER PREFERRED"

These are quotes from reports on recent field comparison tests. They show you why Airco electrodes are preferred by most welders—often "down to the last man."

Airco electrodes perform better on the job simply because Airco keeps everlastingly at electrode research and field testing.

The latest example: Airco has introduced the first powdered metal stainless steel electrodes—new Easyarc Stainless 308, 316 and 347. Excellent for skip or intermittent welding; unprecedented footage per electrode.

Call your Authorized Airco Dealer. You'll see his phone number listed in the Yellow Pages—under "Welding Equipment and Supplies."

Airco Electrode Pocket Guide—describes over 100 different types of electrodes. Send for your free copy.

AIRCO®

Offices and dealers in most principal cities

AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.

On the west coast — Air Reduction Pacific Company

Internationally — Airco Company International

In Cuba — Cuban Air Products Corporation

In Canada — Air Reduction Canada Limited

All divisions or subsidiaries of Air Reduction Company, Inc.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT • Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** – Industrial gases, welding and cutting equipment • **AIRCO CHEMICAL** – vinyl acetate monomer, vinyl stearate, methyl butynol, methyl pentynol, and other acetylenic chemicals • **PURECO**–carbon dioxide–gaseous, welding grade CO_2, liquid, solid ("DRY-ICE") • **OHIO**–medical gases and hospital equipment • **NATIONAL CARBIDE**–pipeline acetylene and calcium carbide • **COLTON**–polyvinyl acetate, alcohols, and other synthetic resins.

For More Information Circle No. 3 on Reader Service Card.

INDUSTRY **NEWS**

1884: Harnischfeger's original shop.

1959: West Milwaukee, Wis., plant is one of eight in P&H organization.

Harnischfeger Corp. Celebrates 75th Anniversary

The Harnischfeger Corporation has opened its 75th anniversary year with strong emphasis on its plans and prospects for future growth. Included in these plans are the introduction of the other half of the company's new line of DC rotary welders, first models of which were launched in 1958.

From a humble start in 1884 the company has grown to a positioner as a major producer of welding electrodes, machines and positioners, of cranes, power shovels and hoists and diesel engines and prefabricated homes. It has eight manufacturing plants in this country and manufacturing affiliates in seven foreign countries.

Welding highlights in the company's history included introduction of welding machine line in 1932 (85,000 units produced to date), introduction of welding electrodes in 1936 (600,000,000 pounds to date) and introduction of P&H positioner line in 1946.

Engineers Recognize OSU's Welding Department

Ohio State University curriculum in Welding Engineering has been accredited by the Engineers Council for Professional Development. The first in the country, the accreditation was granted by the ECPD, a joint organization of the founding engineering professional societies and engineering educators.

A curriculum for the degree of Bachelor of Welding Engineering was approved in October, 1947, by the University and a new department established. The department has graduated some 92 with bachelor degrees and 13 with master of science degrees.

Welding Engineering was added to the Professional Engineer group by the State of Ohio in 1950.

Build Giant West Coast Dip Brazing Installation

Construction of a new aluminum dip brazing installation with the largest capacity in the West has been announced by Meridian Metalcraft, Inc., Whittier, Calif. The new facility is completely equipped for quantity production of aluminum assemblies. The main brazing tank measures 36- by 36- by 60-inches in depth.

A 2,400 square foot concrete building has been erected to house the new production equipment and the 45 cubic foot brazing tank.

COMING EVENTS

January 28-29: 5th annual Midwest Welding Conference, Armour Research Foundation of Illinois Institute of Technology, Chicago.

January 26-29: Plant Maintenance and Engineering Show, Cleveland Public Auditorium, Cleveland, Ohio.

March 16-20: 11th Western Metal Exposition and Congress, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles.

April 7-10: 1959 AWS Welding Show, International Amphitheatre, Chicago, Ill.

April 18-22: American Society of Tool Engineers Annual Meeting, Schroeder Hotel, Milwaukee, Wis.

May 4-7: Annual NWSA Convention, Fairmount Hotel, San Francisco.

May 25-29: Design Engineering Show, Convention Hall, Philadelphia.

November 2-6: 41st National Metal Exposition and Congress, International Amphitheatre, Chicago.

Crucible Stops Making Stainless Electrodes

Crucible Steel Company of America has announced its withdrawal from the stainless welding electrode business. However, the company will continue to manufacture and sell stainless core wire to electrode manufacturers and spooled and layer-wound wire to the manufacturers of welding equipment.

Crucible will continue to produce and sell the Rexweld line of special hard facing alloys.

more news on page 14

For More Information Circle No. 37 on Reader Service Card.→

World's largest dump truck

welded with P&H Low-Hydrogen Electrodes

4000 lbs. of P&H 17-1 electrodes used to fabricate 165-ton capacity frame and box

The mammoth "Eucnik" goes Mohammed one better — it hauls the mountain wherever Western Contracting Corp. of Sioux City, Iowa wants to put it! The specially-built giant moves 165 tons of shale per trip from borrow pit to fill area on the U. S. Corps of Engineers Oahe Dam project near Pierre, South Dakota.

The "Eucnik" represents American co-operative ingenuity at its best. It combines the inventiveness of Hubert Everist, Jr., equipment manager at Western — the new techniques developed by Eaton for fabricating and welding high tensile steel—and the superior weld-ability of P&H 17-1, low-hydrogen electrodes. The result: *a trailer that has twice the tensile strength (110,000 psi) and weighs 12½ tons less* than one made of standard steel!

Take a tip from Eaton — use P&H Low-Hydrogen Electrodes to weld high tensile steels which will be subject to severe impacts and gruelling service. Tensile strengths up to 183,000 psi for fast, X-ray-quality welding with little or no pre-heat. Get Bulletins R-29 and R-26—write Dept. 301C, Harnischfeger Corp., Milwaukee 46, Wisconsin.

P&H HARNISCHFEGER
WELDERS · ELECTRODES · POSITIONERS

Photo by U. S. Corps of Engineers

Ranite Hardsurfacing Rods are So Easy to Use they've earned the title, "The Weldor's Rod"

NINE ADVANTAGES combine to make Ranite metallic-coated rods easiest to use:

1. Operation is equally good on AC and DC machines.
2. Application is practical in *all positions* – including vertical and overhead!
3. Arc is very quiet and stable.
4. Loss from splatter is eliminated.
5. There is no slag to remove.
6. Clear welding vision is maintained.
7. Arc can be re-struck instantly, if broken, because of metallic coating.
8. Rapid deposition rate gets the work done fast.
9. Latitude is very broad—just five Ranite rods—A, BX, C, D and No. 4—handle the *great majority* of all jobs—makes selection quick and easy! (Other Ranite rods available to meet every requirement.)

GET FREE Ranite Select-O-Graph Guide—shirt pocket size—shows best rod to meet any wear condition. Ask your Ranite representative or write direct.

Originators and pioneers of metallic-coated rods–since 1938.

Ranite
WELDORS' NO. 1 CHOICE FOR HARDSURFACING

RANKIN MANUFACTURING CO.
616 So. Marengo Ave., P. O. Box 631
Alhambra, Calif.

For More Information Circle No. 54 on Reader Service Card.

A.W.S. members plan as . . .

A.S.M. Sponsors 11th Western Metal Congress

New alloys and fabricating processes will be featured in the 11th Western Metal Exposition presented by the American Society for Metals at Los Angeles' Pan-Pacific Auditorium on March 16-20. On those dates, the 11th Western Metal Congress will be held in the Ambassador Hotel.

A welding program is being set up by western sections of the American Welding Society. Working on the program are Robert J. Frick, chairman of the program committee (above, right), John B. Ross, chairman of the Los Angeles AWS section (above, left) and Richard C. Hayes (standing).

Linde Issues Film On Tungsten Arc Welding

"Introduction to Manual Heliarc Welding" is the title of an 8-minute sound and color 16 mm. motion picture issued by Linde Company, Division of Union Carbide Corp. It is available without charge from any Linde office.

All-State Sets Up Canadian Subsidiary

A wholly-owned Canadian subsidiary has been incorporated by All-State Welding Alloys Co., Inc. Located in Toronto, Ontario, All-State Welding Alloys Co. of Canada, Ltd., will distribute alloys and fluxes Indications are that manufacture of alloys and fluxes will follow immediately.

more news on page 78

You get VICTOR QUALITY thru-out this package

We've assembled the Super-Range unit for the man who wants a first-class, complete outfit, ready to handle a full range of shop work—welding, cutting, heating, brazing, soldering. Everything needed to go right to work is included.

Every item listed is Victor's standard, top-quality apparatus . . . and you get the complete outfit for only $99.00. Order from your Victor dealer now.

Profitable dealerships open in a few areas; inquire now.

Two Victor single-stage safety regulators,
Model SR 210-970 Acetylene
Model SR 200-967 Oxygen

Victor welding torch Model 100

Victor cutting attachment Model 550-100

Victor welding torch nozzles, Type 13, sizes 0, 2, and 4; (welds to ¼")*

Victor cutting tip, Type 5-101, size 1; (cuts to 1")*

12½ ft. dual welding hose, 3/16" diameter

Spark lighter, goggles, and wrench

*By adding Victor nozzles and tips of larger or smaller capacities to Super-Range unit, you can greatly increase the working range.

VICTOR
for welding

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; high pressure and large volume gas regulators; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines. 54

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J. C. Menzies & Co., wholly owned subsidiary

For More Information Circle No. 70 on Reader Service Card.

MEN ON THE MOVE

in the welding industry

McElhoe

Yasko

Landrum

Lenhard

Roberts

Price

APPOINTMENTS:

H. L. McElhoe has been named general manager of the Southern Sales Division of *National Welding Equipment Company*, according to **Ernest L. Mathy**, president and general manager. McElhoe will establish warehouses, sales offices and repair depots and will set-up and service welding supply distributors.

Laurence J. Berkeley, president and general manager of *the Berkeley Company*, Danville, Illinois, has announced the appointment of **Stephan Yasko** to the position of vice president and director of sales. Yasko was formerly manager of sales engineering of the *Westinghouse Electric Corporation, Welding Division*, Buffalo. He has 17 years experience in the metalworking field.

Tom Earlbeck is a welding technician trainee at *Earlbeck & Landrum, Inc.*, Baltimore, Md., welding supply distributor. Announcement was made by Tom's dad, President **Al Earlbeck.**

United Specialties, Inc., has appointed two sales representatives. **Archie A. MacIntyre** will cover Eastern Michigan out of Detroit; **Ray B. Conklin** will cover western New York and northern Pennsylvania out of Buffalo.

Harnischfeger Corporation has announced the appointment of **Ed Schwall** as regional representative for welder sales in Utah, Colorado, Arizona and New Mexico.

Edward C. Moore has joined the sales staff at *Welding & Cutting Supply Co.*, Cleveland, Ohio, according to **M. M. Powar,** president. Moore was formerly with N.A.C.A. and Harris Calorific Company.

Alfred Bleiweis has been named welding engineer of the *Elizabeth Iron Works, Inc.*, Union, N.J., by **Irving Diamond,** company vice president.

Dr. Gerard E. Claussen has been named director of research and welding engineering for *Arcrods Corporation*, major producer of welding electrodes.

PROMOTIONS:

R. E. Lenhard, executive vice president of *Air Reduction Sales Company*, the industrial gases and welding products division of *Air Reduction Company, Inc.*, has been appointed president of that division. He succeeds **J. H. Humberstone** who, as vice president of *Air Reduction Co., Inc.*, will devote full time to corporation affairs.

Wilmot F. Wheeler, Jr., formerly vice president of *American Chain & Cable Co., Inc.*, has been elected executive vice president and a director of the Corporation.

John Painter, New York district manager for the Welder Division of *Harnischfeger Corp.* is now also in charge of New York export sales of welder equipment for the company.

Thomas R. Gerosky has been named district sales manager for the Chicago, Illinois, territory of *American Chain Division, American Chain & Cable Co., Inc.*

President Glendon H. Roberts of *Detroit Stamping Company* has announced a series of elections and appointments within the corporation: **William H. Roberts** becomes executive vice president; **Harry C. Robeson** becomes vice president in charge of sales of all products; **Herbert McMillan** and **Charles Hoppe** become sales managers of the company's Stamping and Finished Products Divisions, respectively.

Clayton D. Grover, president of *Whitehead Metals, Inc.*, since July, 1954, has been elected chief officer of the company. **Thomas M. Bohen** has been elected Honorary Chairman of the Board of Directors.

Donald L. Price has been elected a vice president at *Norton Company*. He is succeeded as sales manager, grinding wheels, by **Robert Cushman,** formerly manager of marketing services. **Harry G. Brustlin,** West Coast District Manager in Los Angeles returns to Worcester, Mass., to succeed Cushman. **Sidney B. Wetherhead** replaces Brustlin.

The appointment of **Leonard R. Broniak** as general sales manager of *Weltronic Company* Detroit, has been announced by **Cletus J. Collom,** president. Mr. Broniak will head sales of resistance welding controls, electronic power devices and arc welders.

continued on page 18

Produce "Proof-Test" Weldments at Lower Cost

Increase Welding Markets – Simple 4-Point Program

The designer, buyer or user of welded fabrications usually asks for just two things: dependable, consistent quality, delivered at a fair price.

Our Magnaflux 4-point Program helps you to give him both—at a substantially increased operating profit! It has proved that it can increase the number and types of welded components used in all manner of products. Specifically, here is what it can do for you:

1. Improve welding design

Use Stresscoat Brittle Coatings as a stress analysis shortcut, to help design easier-to-produce, more economical welded parts. You'll eliminate guesswork and wasted effort — save money and assure a fabrication right for its job.

2. Establish consistent standards

Know the service requirements you are "shooting" for. Then set the standard of quality that will meet them. This does *not* mean an abstract, costly goal of perfection. Magnaflux Test Methods find all defects in welds that *need to be found* — easily and quickly — in both ferrous and nonferrous metals . . . at any level of sensitivity *you* require.

3. Gain better control of operators

With Magnaflux Test Systems you have a continuous check from stringer bead to finished product. You can spot trouble fast and correct its cause. On multiple pass welds, finding defects at the first pass saves needless waste of money, saves time spent in completing welds certain to be rejected later. This increases productivity!

4. Promote the reputation and acceptance of your weldments

"Tested by Magnaflux" certifies that your welded fabrications are fully reliable for the service for which intended. This recognition helps to create new uses and markets for welded fabrications. It also helps *your own* engineers to design functionally better products at lower cost.

Why not decide now to get the whole story of the Magnaflux 4-Point Test Program — and how it can help you to tap new markets, reduce waste and increase profits. Ask to have your Magnaflux Field Engineer give you the facts, as they apply to your own operation. Write or call for a meeting. No obligation, of course — *but a strong likelihood of better earnings for your company.*

3 Tools for Better, More Profitable Welding — by Magnaflux

MAGNAFLUX-MAGNAGLO for magnetic metals. Prices start as low as $195.

ZYGLO for nonferrous metals, stainless steel. Complete kits as low as $125.

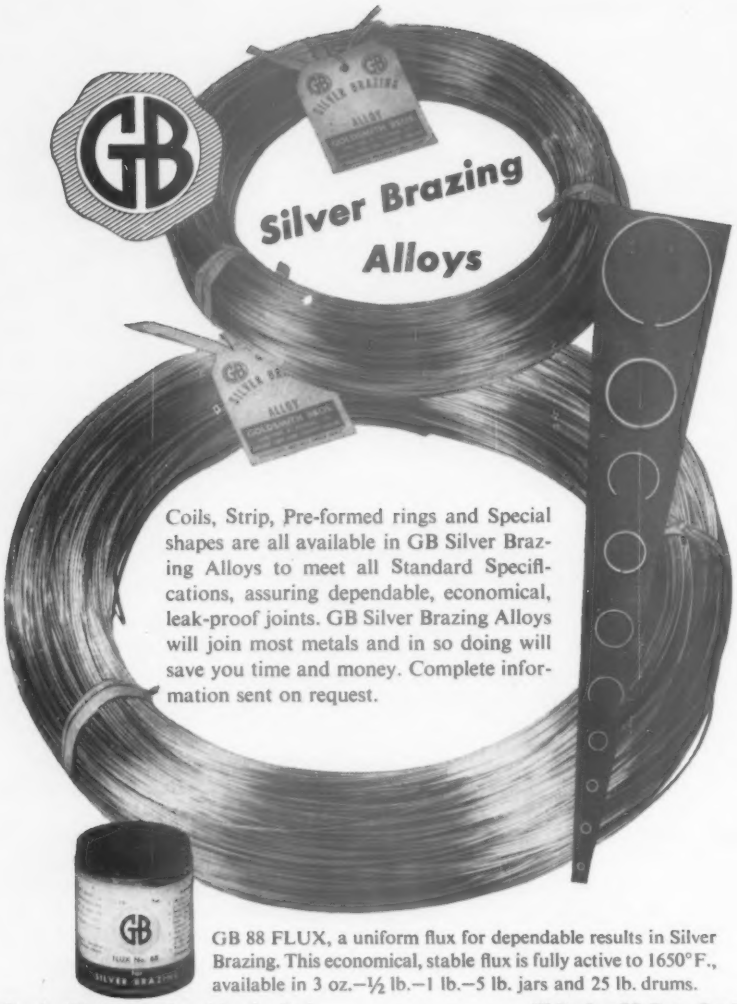
STRESSCOAT Shows where and how high stresses occur — during design or pilot stage.

MAGNAFLUX CORPORATION • 7348 W. Lawrence Avenue, Chicago 31, Illinois

New York 36 • Pittsburgh 36 • Cleveland 15
Detroit 11 • Dallas 35 • Los Angeles 22

The Hallmark of *Quality* in nondestructive test systems

For More Information Circle No. 46 on Reader Service Card.



Coils, Strip, Pre-formed rings and Special shapes are all available in GB Silver Brazing Alloys to meet all Standard Specifications, assuring dependable, economical, leak-proof joints. GB Silver Brazing Alloys will join most metals and in so doing will save you time and money. Complete information sent on request.

GB 88 FLUX, a uniform flux for dependable results in Silver Brazing. This economical, stable flux is fully active to 1650°F., available in 3 oz.—½ lb.—1 lb.—5 lb. jars and 25 lb. drums.

Dealer Distributor Inquiries Invited **Write for GB Data Book**

GB Goldsmith Bros. SMELTING & REFINING CO. Est. 1867

1300 W. 59th Street · Chicago 36, Ill. — NEW YORK · DETROIT · OAKLAND

HAVE YOU INVESTIGATED
THE POSSIBILITIES
OF LOWERING
YOUR METAL JOINING COSTS
BY SWITCHING TO
SILVER BRAZING ALLOY

?

For More Information Circle No. 31 on Reader Service Card.

MEN ON THE MOVE

continued

Barris

Dick

Kepner

Provencher

Appointment of **G. A. Barris** as general manager of the *Stainless Processing Division* has been announced.

Charles M. Dick has been appointed product manager of electrodes by *Metal & Thermit Corp.* The appointment gives Dick responsibility for sales planning and customer service.

I. G. Kepner has been named Pacific Coast Region Manager of Distributor and Apparatus Sales with headquarters in San Francisco by *Linde Company, Division of Union Carbide Corp.*

Alfred "Pete" Provencher has been appointed district manager of *Arcos Corporation's* Chicago district office. He is succeeded as New England district manager by **Carl Gage.**

Mitchell P. Kartalia, manager *of Square D Company's* marketing division, has been elected a vice president.

DEATHS:

The welding industry is mourning the recent death of **Ernest F. Meier,** technical assistant to the general manager of the *Glascote Division of A. O. Smith Corporation,* Cleveland. Mr. Meier served as chief maintenance engineer for *Monsanto Chemical Co.* for 30 years. He is a past chairman of the St. Louis AWS Section.

For More Information Circle No. 30 on Reader Service Card.→

FULL-LOAD TESTED!

Only G-E Ignitrons Come PROVED for Welding Service!

General Electric is the only builder of ignitrons to use test equipment which fully proves tubes under actual welding conditions. Tests are made at voltages and currents exceeding maximum requirements.

Occupying over 3,100 cubic feet of area, General Electric's extensive test equipment probes for—and rejects—any operating faults which might affect the performance of G-E ignitrons in your plant, such as improper ignitor firing, tube arc-backs, etc.

Here is unexcelled protection for your dollar investment in ignitrons! Here is the best possible assurance that your welder downtime will be kept low—that production will remain high.

Install General Electric *full-load-tested* ignitrons! Made in the widest range of sizes and types. Fully competitive in price . . . stocked by a G-E tube distributor who is near you. Phone him! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

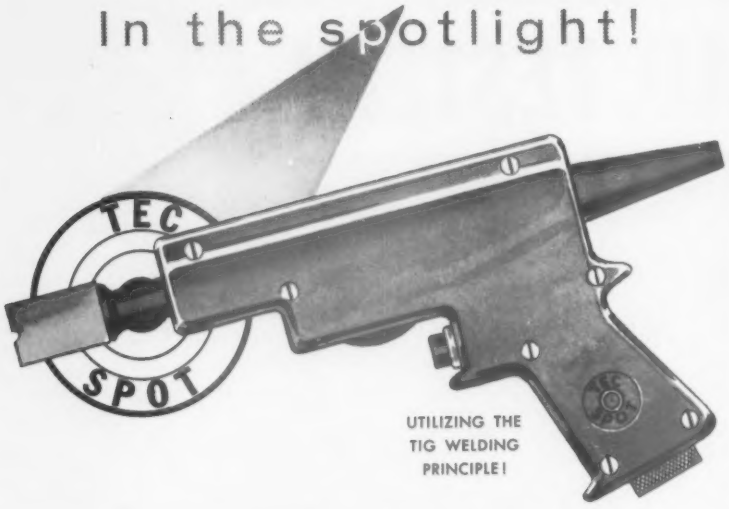
Progress Is Our Most Important Product

GENERAL ELECTRIC

11-12-102

For More Information Circle No. 30 on Reader Service Card.→

In the spotlight!



the TEC SPOT GUN

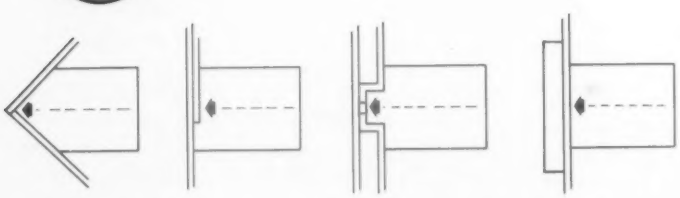
Perfectly meeting the demand for a production tool to bridge the gap between resistance welding and arc welding.

Spot weld all gauge thickness joints from ONLY ONE SIDE . . . weld up to 1/8" thickness to ANY STOCK SIZE regardless of THICKNESS . . . uses Argon and/or Helium gases.

Exclusive tip-of-torch cooling . . . touch starting is eliminated through high frequency initiation and no pressure is required

LIGHTEST WEIGHT TIG spot gun on the market . . . ONLY 12 OUNCES! Modern design to comfortably fit the operator's hand for faster operation.

ECONOMICAL . . . Maintenance is practically eliminated because there are no moving parts to wear.



Eight standard Locators available for most job applications. Locators for special joints available on request.

Write NOW for full information on the TEC Spot Gun and other Superior Visuweld Equipment

TEC TORCH CO., INC. 300 PATERSON AVENUE CARLSTADT, NEW JERSEY

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LIBRARY

of welding

NEW AWS WELDING SYMBOLS

Standard Welding Symbols (AWS A2.0-58), American Welding Society, American Welding Society, 33 West 39th Street, New York 18, N.Y.; $3.00 (booklet), $1.50 (wall chart) and $.50 (desk chart).

The first major change in welding symbols in recent years has been announced by the American Welding Society.

The new standard contains these new symbols: symbols for spot and seam welds made by arc welding; symbols for welds used in aircraft, guided missile and automotive works; and symbols for the types of welds used in structural steel fabrication and reinforced concrete work.

The standard also contains a table which provides a new system for designating welding and cutting processes by letters. The system covers 37 commercially used welding processes and also provides a means for indicating: automatic welding, machine welding, manual and semi-automatic welding.

The welding symbols chart has been redesigned to incorporate these new developments. A new arrangement simplifies the recognition of the symbols.

GRINDING WHEEL SAFETY

Safety Recommendations for Grinding Wheel Operation, Grinding Wheel Institute, 2130 Keith Building, Cleveland 15, Ohio, no charge.

The Safety Committee of the Grinding Wheel Institute has published this 24-page safety booklet.

This booklet discusses in layman's language such technical subjects as maximum peripheral speeds, strength classification of grinding wheels, definitions of maximum speeds, the effect of wheel speed on grinding action, safety guards, mounted wheels, proper mounting procedures, truing and dressing, and the do's and don'ts for safe grinding.

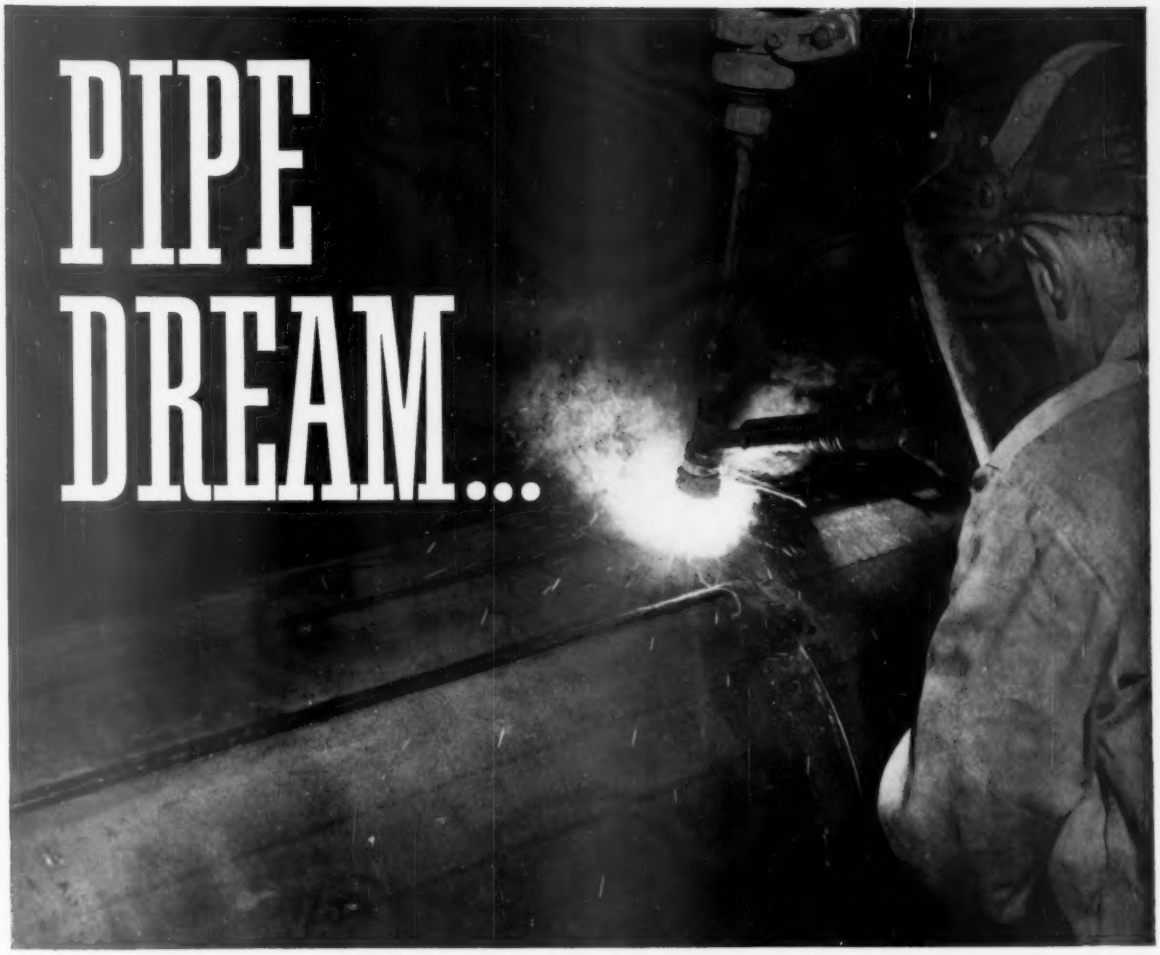
It also contains a handy table for converting revolutions per minutes (rpm) to surface feet per minute (sfpm).

ARC WELDED MACHINERY

Arc Welding in Machinery Design and Manufacture, The James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio; $2.00 in U.S.A., $2.50 elsewhere, postage paid.

This is a book of ideas for the efficient use of welded steel in machine design and manufacture. Part I contains suggestions, check lists and guides for designing better ma-

continued on page 23



...UNIONARC Welding saves $7000 on one production run

UNIONARC Welding—LINDE's new electric welding method for steel—increased production by 300% and saved a western pipe mill $7000 on a single run of steel pipe. Replacing covered electrode methods, UNIONARC Welding is expected to save this company $150,000 a year.

UNIONARC Welding uses a continuously-fed wire electrode, magnetically coated with flux and shielded with carbon dioxide gas. It has three times the speed and weld penetration of covered electrode welding. And UNIONARC Welding gives you "finished", X-ray quality welds and low hydrogen deposits—in all welding positions.

See for yourself—ask your nearest LINDE representative to *prove* that UNIONARC Welding slashes time and labor costs over conventional methods. Call your local LINDE office today! Or write Dept. IW-2 LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in other principal cities. In Canada: Linde Company, Division of Union Carbide Canada Limited.

Linde TRADE-MARK

UNION CARBIDE

"Linde", "Unionarc", and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

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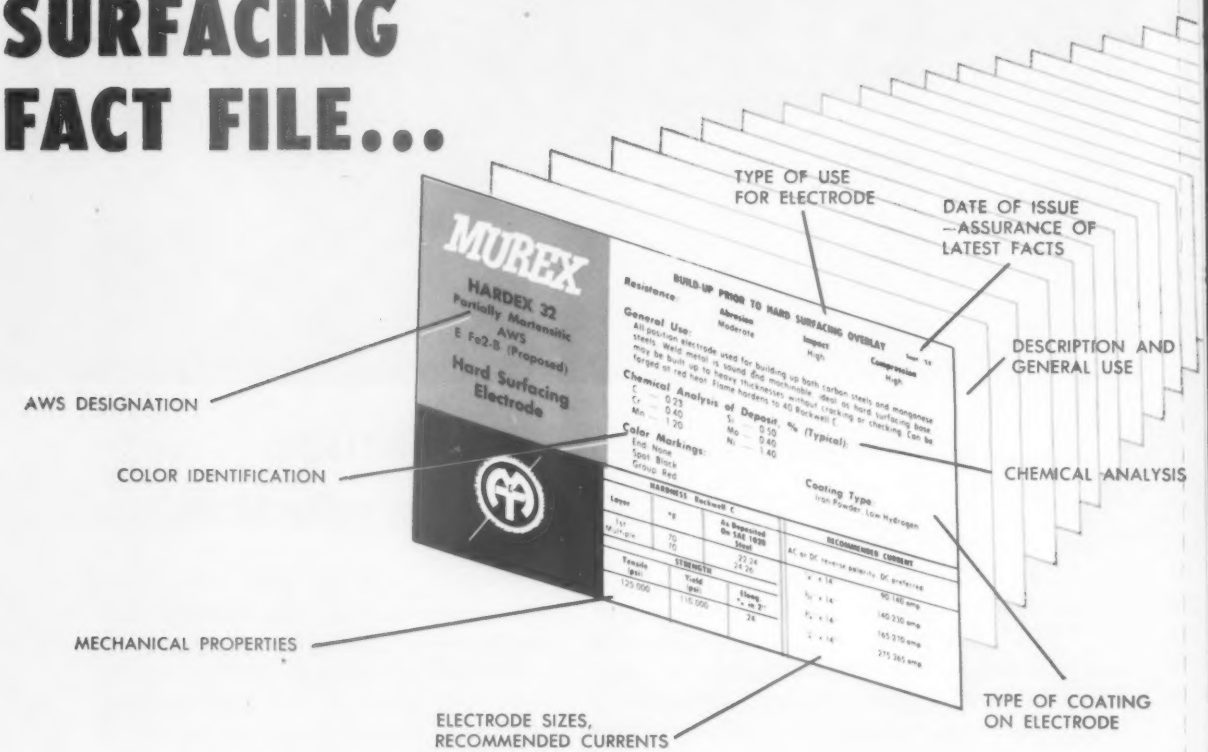
For More Information Circle No. 63 on Reader Service Card.

continued on page 23

Just Off the Press

NEW MUREX HARD SURFACING FACT FILE...

Here for the first time is a complete, easy-to-use, 3″ x 5″ reference file for all hard surfacing information. Packed with these helpful facts, it eliminates guess work, helps pin-point the right electrodes or wires for your application:



SEND FOR YOUR FREE FILE TODAY...

The Murex Hard Surfacing Fact File contains a Master Selector Card that indicates the right electrode or wire for your application . . . Data Cards for each electrode . . . and a registration card that helps us to keep you up to date with informative material. *Metal & Thermit Corporation, Rahway, New Jersey.*

MUREX®
PRODUCTS FOR BETTER WELDING

For More Information Circle No. 48 on Reader Service Card.

WELDING LIBRARY *continued*

chines at lower costs; Part II contains reviews of 73 machine designs to illustrate how welded steel is used to solve problems of design and manufacturing.

The book is cross-indexed as to types of machinery, types of components and types of design or manufacturing problems.

The book contains 224-pages and is completely illustrated with photographs and drawings. It has gold embossed board covers.

SIMPLIFICATION OF A.S.M.E. CODE

The Unfired Pressure Vessel Code Simplified (1958 edition), Robert Chuse, P.O. Box 91, Leonia, N.J., $6.50 (single charts: $1.00)

This publication is a simplified analysis of the A.S.M.E. Unfired Pressure Vessel Code. It makes the Code easy to use and can save time and materials.

In the book's 48 pages are simplified charts for internal and external pressure, shell thickness, flanged and dished head thickness, flat head thickness, flat cover plate thickness and openings and reinforcements. It also includes new charts on external pressure on heads, stamping, head and shell volumes, welding qualification positions, new information on magnetic particle and penetrating oil tests, plate identification, non-identified material, articles on Canadian pressure vessel requirements, the Code symbol and certificate-procedure to follow to obtain them and welded repair procedure.

ALUMINUM WELD RADIOGRAPHS

Booklet H3/58: "Classified Radiographs for Defects in Aluminum Fusion Welds," British Welding Research Association, 29 Park Crescent, London W1; 10 schillings.

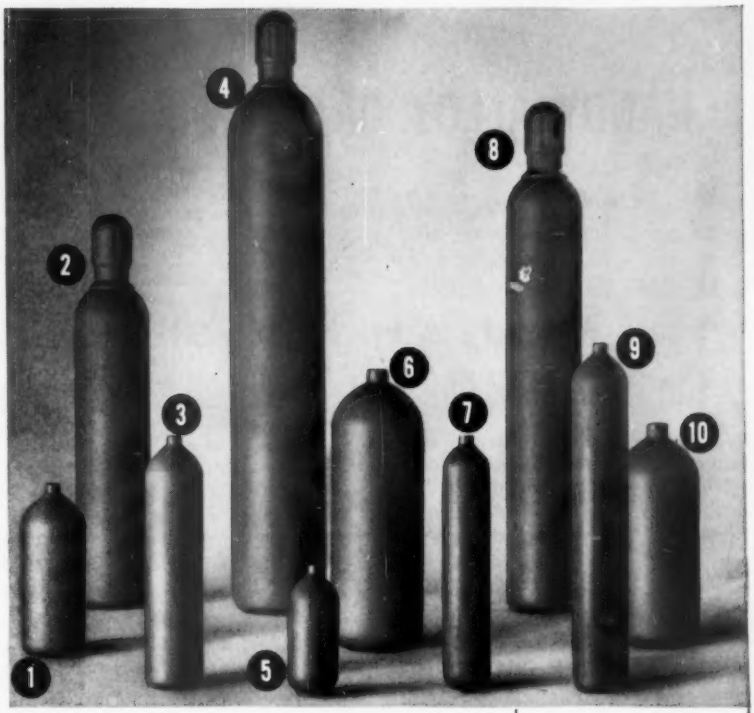
This booklet shows how to identify defects in aluminum fusion welds which can be seen in radiographs. The defects are classified, their origin explained and suggestion made for their prevention.

The book recognizes five groups of defects: cracks; lack of fusion, including incomplete root penetration; voids, including three types of porosity; inclusions; and imperfect shapes.

Surface marks give characteristic shadows in radiography and are also included although they are not actually defects.

General indication are given of the ways in which the defect influence joint properties.

The book is well indexed for easy reference. It measures 5½- by 8½-inches and contains 53 illustrations.



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6. 20-lb. CO-2 7.45" x 23¼"
7. 11 cu. ft. oxygen 3⅜" x 18⅞"
8. 110 cu. ft. oxygen 6⅝" x 43"
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HANDY ALLOY DATA SHEET

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NAME		SILVER	COPPER	ZINC	OTHER	MELTING POINT °F	FLOW POINT °F	TROY OUNCES PER CU. IN.
EASY-FLO		50%	15½%	16½%	(18% Cd.)	1160	1175	5.00
EASY-FLO #3		50	15½	15½	(16% Cd. 3% Ni.)	1170	1270	5.00
EASY-FLO 45		45	15	16	(24% Cd.)	1125	1145	4.92
EASY-FLO 35		35	26	21	(18% Cd.)	1125	1295	4.90
SIL-FOS		15	80	—	(5% P.)	1185	1300	4.45
SIL-FOS 5		5	88.75	—	(6.25% P.)	1185	1300	4.37
NEW NAME	**FORMER NAME**	**SILVER**	**COPPER**	**ZINC**		**MELTING POINT °F**	**FLOW POINT °F**	**TROY OUNCES PER CU. IN.**
BRAZE TEC*	TEC*	5	—	—	(95% Cd.)	640	740	4.60
" 056*	TEC-Z*	5	—	16.6	(78.4% Cd.)	480	600	4.53
" 071	SN #7	7	85	—	(8% Sn.)	1225	1805	4.82
" TL	TL	9	53	38		1410	1565	4.50
" 202	AT SPECIAL	20	45	35		1315	1500	4.68
" ATT	ATT	20	45	30	(5% Cd.)	1140	1500	4.64
" NE	NE	25	52½	22½		1250	1575	4.71
" 251	AE	25	57.5	17.5		1255	1625	4.68
" SS	SS	40	30	28	(2% Ni.)	1220	1435	4.76
" 404	SS-5	40	30	25	(5% Ni.)	1220	1580	4.72
" DT	DT	40	36	24		1235	1415	4.80
" DE	DE	45	30	25		1230	1370	4.82
" ETX	ETX	50	34	16		1250	1425	4.99
" 541	ALLOY-4772	54	40	5	(1% Ni.)	1340	1575	5.06
" 560	ER	56	22	17	(5% Sn.)	1145	1205	5.00
" 580	EB	57.5	32.5	—	(3% Mn.- 7% Sn.)	1120	1345	5.05
" RT	RT	60	25	15		1245	1325	5.02
" 603	RT-SN	60	30	—	(10% Sn.)	1115	1325	5.23
" 630	RSNI	63	28.5	—	(6% Sn.- 2.5% Ni.)	1275	1475	5.12
" EASY	EASY	65	20	15		1235	1325	5.06
" MEDIUM	MEDIUM	70	20	10		1275	1360	5.14
" BT	BT	72	28	—		1435	1435	5.24
" HARD	HARD	75	22	3		1365	1450	5.28
" 752	TR #1	75	—	25		1300	1330	5.06
" IT	IT	80	16	4		1345	1490	5.29
" 852	85 Ag.-15 Mn.	85	—	—	(15% Mn.)	1760	1780	5.08

*A Solder—Not a Brazing Alloy

Space does not permit listing the many special alloys, formulated for a particular or unique application. Handy & Harman Brazing Engineers and Technical Service are always ready to work closely with you on metal-joining problems and methods.

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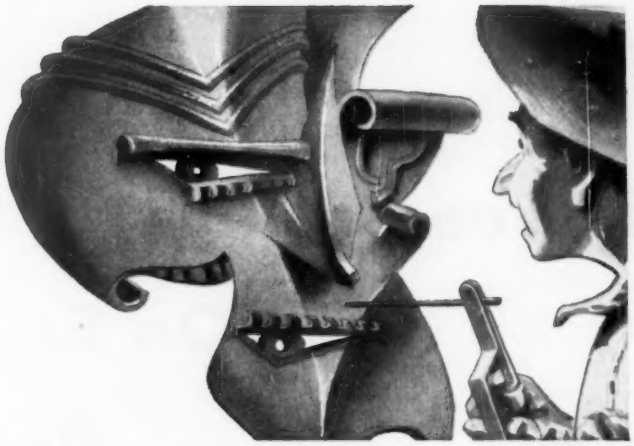


"The Thing"

If I had a crystal ball that Saturday afternoon about two weeks ago, I would never have answered the phone.

"Nick..." the unfamiliar voice said, "this is Herman at Ace Welding."

"Herman? Where's Burt Shawl?" I asked.

"He and his missus went on a trip. Burt told me that if I run into trouble to call you. And boy! do I have trouble..."

"What's the matter?"

"A lady...as nutty as a fruit cake...is in here with the weirdest-looking thing. She calls it a mask and she wants it welded to a copper hanging plate."

"A mask?"

"Yes...and you should see it, Nick. There's an eye where the mouth should be. A nose where an ear should be. And an ear where a nose should be. The lady says the thing is called 'Man'. Boy, I'd hate to meet a man like that on a dark night."

When he said that I laughed so hard it hurt. I roared, "Better mount it to the plaque but quick before it starts to move!"

"But that's my problem! The lady insists on welding the mask to a copper plate. And the mask is stainless. Put lugs on it and mount it? NO she says. Everything in her house must be welded. She says her husband won't have it any other way."

"Maybe he modeled for the mask?" I chuckled.

"Wouldn't be surprised," Herman laughed. "But what can I do? I can't weld stainless to copper!"

"Sure you can, Herman."

He was silent. Then he blurted out. "But how?"

"With '141'* Nickel electrodes."

"'141' Nickel electrodes?" he puzzled. "We have a supply... but will it do the job? This mask weighs a ton."

"Will it do the job...? Why, Herman, they use '141' Nickel electrodes to build copper-lined stainless steel vacuum furnaces, retorts and those big copper-lined stainless beer vats at Jake's brewery! In fact, just the other day I was out to a job where the weldor was working with copper and 347 stainless. He made a single vee butt joint. An 80° included joint angle. First he heated the copper plate to about 950°F. He overlayed the beveled edge with four overlapping stringer beads using 1/8" diameter '141' Nickel electrodes. He got a two layer overlay about 3/16" thick which he ground and then welded to the stainless using 3/16" diameter electrodes."

"Sounds terrific... but was it a sound weld?"

"Sound, Herman? It has tensile strength of about 33,200 PSI. It'll put that mask of yours on the copper for good. That will more than satisfy the lady's crackpot husband!"

"Just wait a minute, Nick... I'll tell the lady."

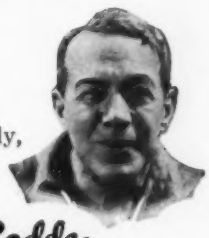
I heard him call... "Mrs.... Mrs.... By the way, what *is* your last name?"

"Rodder... Mrs. Goldie Rodder," I overheard.

That's when I passed out!

Well, I still think the mask is ridiculous. But every time I pass it in our hall I admire Herman's neat welding job. You can do as neat a welding job, too, on copper and stainless. Why not write me in care of Inco for "Inco Welding Products"?

Sincerely,



Nick Rodder

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street INCO **New York 5, N.Y.**

*Registered trademark

For More Information Circle No. 41 on Reader Service Card.

High Speed Stud Welding On Bridge Beams

OPERATOR WELDS hundreds of shear connectors to heavy I-beam flanges. He locates them with a template, has a handy supply of them on rack alongside beam.

IN BRIEF: Stud welding makes possible low cost composite bridge construction.

WHEN CONCRETE IS POURED around shear connectors, in the form of studs welded to the girders you have what is termed "composite construction." The studs bind the concrete to the steel so that both the steel and concrete are load bearing.

Welding studs to structural beams is not new for Elizabeth Iron Works of Union, New Jersey; they have fused thousands by stud-welding which is a fast, positive way if care is exercised.

First: To make acceptable welds, there must be sufficient D. C. for welding. With insufficient current, "cold welds" will be produced; and, along with that, arc blow, porosity, erratic arcing or uneven fillets. Elizabeth Iron makes sure they have sufficient welding current as well as A. C. power; voltage drop is kept within 3%. Elizabeth Iron also makes sure the power cable to the gun is big enough and that there is a good ground connection.

Second: The company finds it a good practice to make a few test welds at the start of each day. They hammer these studs until they bend. If the welds don't tear or crack, they are accepted.

Third: Operators, foreman and inspectors are trained to distinguish good welds from the bad, how to detect and correct faulty operating conditions and how to handle and maintain the stud welding equipment.

Fourth: The heavy rolled beams have to be free of mill scale, dirt, oil, and grease before stud welding. The fast, effective way the company uses to get rid of scale is to use a hammer punch in conjunction with the stud-locating template. One crack with a hammer descales the entire weld area.

Fifth: Stud positioning has to be fast to keep the job rolling. A simple template quick-clamped to the flange does the trick. A supply of a dozen studs is kept handy on a loading board hooked over one edge of the beam flange. This board slides along as work progresses.

The generator is set between 1,650 and 1,800 amps for ¾-inch studs. The ⅞-inch takes top current (about 2 ,100 amps) and wide open voltage. The control timer has a range of 3 to 80 cycles. The best welds are made with 40 to 45 cycles on ¾-inch studs, and 55 to 60 cycles on ⅞-inch studs.

The completed beam fairly bristles with studs that are on for good. • •

STUD WELDED I-beams on the job (right); beams in storage (below).

50-KW induction heating machine silver brazes 85 joints an hour

BRAZING: Operator holds automatic transmission cover assembly. Mounting posts, induction coils and air jets and hold-down plungers are visible in brazing machine.

Automatic Equipment Brazes And

IN BRIEF: Seven joints in an automatic transmission cover are assembled, brazed and tested by a single operator in less than four minutes. Reject rate is less than one percent.

SEVEN JOINTS in an automatic transmission cover are assembled, brazed and tested by a single operator in less than four minutes' working time. With automatic equipment, conveniently laid out in a compact work area, one man produces 85 high-strength silver brazed joints an hour with a reject rate of less than one percent.

The cover, which forms part of the housing for the automatic transmission used in light duty trucks, is made in the Indianapolis plant of a major automotive manufacturer's division. The assembly consists of 12-inch diameter drawn steel covers, having six ⅜-inch diameter studs and a 1¾-inch tubular hub projecting through the bottom. For speed, simplicity and strength, these seven parts are silver brazed to the cover in one operation in a 7-coil induction brazing machine.

Assembly: The operator assembles the parts with the cover cradled in a simple fixture. This fixture consists of four blocks which raise the cover off the work surface to provide clearance for the projecting studs and hub. Before insertion, the studs, hub and areas surrounding the holes in the cover are given a protective flux coating. This is brushed on from a warmed flux pot. Prewarming the flux makes it active at a lower work temperature, giving the parts maximum protection against oxidation as they are heated. During assembly, a .062-inch gage ring of Handy & Harman's Easy Flo 45 silver brazing alloy is preplaced like a spacer between the inside surface of the cover and each part. Diametral clearance between the parts and the holes is .005-inch.

Brazing: The assembly is brazed in a 50-kw induction heating machine. The cover is heated from the underside so that molten silver alloy is drawn down from the upper surface and brazes the joint completely from top to bottom. The holding fixture consists of four T-shaped posts which support the rim of the cover. These also position the cover so the six studs and the hub are centered in their individual induction

ASSEMBLY: Covers are assembled and placed in automatic induction brazing machine at operator's rear.

TESTING: Joints are checked in pneumatic test fixture Pressure drop on gages indicate imperfect joints.

Tests 7 Joints In 4 Minutes

coils. Since the studs are located near the cover's sidewall, the heating coils are shaped to an approximate right angle to heat evenly both the side and bottom area around each stud.

The six studs and the hub are held in position by the top section of the brazing fixture. This consists of seven spring-loaded plungers mounted on a common base plate that is raised and lowered pneumatically. The plungers keep the parts from shifting during the brazing cycle and provide the follow-up pressure that seats them against the cover when the brazing ring melts and flows. The 25-second brazing cycle is started automatically when the cylinder-operated section is lowered onto the cover. At the end of the cycle, the current shuts off and the assembly is cooled for 35 seconds by air jets centered in each of the coils.

At the end of the cycle, the brazed cover is transferred to a dip tank beside the brazing machine. Here, flux residue is washed off. Putting these two operations side by side lets the same operator handle both steps conveniently. It also decreases soaking time since the flux is easier to remove while it is still warm. The covers are supported in the bath by an open rack made of angle irons, with the flanges cradled in the flat of the angle iron. The rack is raised and lowered pneumatically.

Testing: Because the automatic transmissions operate in a fluid medium, they must be leak-tight. Every cover assembly is checked for joint soundness. The cover is placed in the test fixture with the six projecting studs inserted into sockets mounted on the base plate. Each socket contains an O-ring that forms an air-tight seal around each stud. After pneumatically lowering a circular holding plate onto the top of the cover, the operator lets air pressure into the six sockets. Each joint is subjected to 80 psi. An imperfect joint can be spotted by a pressure drop indicated by a corresponding pressure gage on the panel behind the tester.

Any leakers are set aside and rebrazed with a hand torch.

Later on in production, every joint is also shear tested for mechanical strength with a torque wrench at a 45-foot pound loading. This is well below the 40,000 psi average shear strength of a good silver braze in carbon steel.

	Base Metal Type	Condition (In which weldment will be placed in service)	Electrode (Or filler rod) Type Designation	Remarks
Ferritic Chromium Grades	405	Annealed	405 Cb 430	Annealing is employed to improve ductility of base metal heat-affected zones and weld metal. Type 405 weld metal contains columbium rather than aluminum to reduce hardening.
		As-Welded	308 309 310	These austenitic weld metals are soft and ductile. However, base metal heat-affected zone has limited ductility.
	430	Annealed	430	Annealing employed to improve weld joint ductility.
		As-Welded	308 309 310	Weld metal is soft and ductile, but base metal heat-affected zones have limited ductility.
	430 Ti	As-Welded	308 309 310	Type 430 Ti base metal is designed for improved as-welded ductility in heat-affected zones. Type 430 Ti filler metal should be deposited only with inert-gas shielded arc welding process.
	430 F	Annealed	430	Remarks on Type 430 base metal apply.
		As-Welded	308 309	Remarks on Type 430 base metal apply.
	442	Annealed	442	
		As-Welded	308 309 310	Consideration must be given to difference in coefficient of expansion of base- and weld-metals.
	446	Annealed	446	
		As-Welded	308 309 310	Type 308 weld metal can be used, but will not display scaling resistance equal to the base metal. Consideration must be given to difference in coefficients of expansion of base- and weld-metals
Martensitic Chromium Grades	403 410	Annealed or Hardened and Stress-Relieved	410	Annealing employed to soften and impart ductility to heat-affected zones and weld. Weld metal responds to heat treatment in a manner similar to the base metal.
		As-Welded	308 309 310	These austenitic weld metals are soft and ductile in as-welded condition. However, base metal heat-affected zone will have limited ductility.
	416	Annealed or Hardened and Stress-Relieved	410	Remarks on Type 410 base metal apply.
		As-Welded	308 309	Remarks on Type 410 base metal apply.
Chromium-Nickel Grades	301 302 304 305 308	As-Welded or Fully Annealed	308	Type 308 weld metal is also referred to as 18-8 and 19-9 composition. Actual weld analysis requirements are 0.08% maximum C, 19.0% minimum Cr and 9.0% minimum Ni.
	302B	As-Welded	309	Type 310 weld metal may be used, but the pickup of silicon from the base metal may result in weld hot cracking.
	304 L	As-Welded or Stress-Relieved	347 308 L	
	303	As-Welded or Fully Annealed	312	Free-machining base metal will increase the tendency for hot cracks to form in weld metal. Type 312 weld metal contains a large amount of delta ferrite to overcome this cracking tendency.
	309	As-Welded	309	
	310	As-Welded	310	
	316	As-Welded or Fully Annealed	316 310 Mo*	*Welds made with Types 316, 316 L, 317, 316Cb and 317Cb electrodes may occasionally display poor corrosion resistance in the "as-welded" condition, particularly where hot oxidizing acids are involved. In such cases, use Type 310Mo weld metal, with carbon content not over 0.12%. If this electrode is not readily available, corrosion resistance of the other weld metals listed above may be restored by the following heat treatments: (1) For Types 316 and 317 Base Metal—Full anneal at 1950-2050 degrees F; (2) For Types 316 L and 317 L Base Metal—A 1600 degree F stress-relief; (3) For Type 316Cb Base Metal—A 1600-1650 degree F stabilizing treatment.
	316 L	As-Welded or Stress-Relieved	316 Cb 316 L 310 Mo*	
	316 Cb	As-Welded or after stabilizing and stress-relieving heat treatment	316 Cb 310 Mo*	
	317	As-Welded or Fully Annealed	317* 310 Mo*	
	317 L	As-Welded or Stress-Relieved	317 Cb 310 Mo*	
	321	As-Welded or after stabilizing and stress-relieving heat treatment	347	Type 321 electrodes are not regularly manufactured because titanium is not readily recovered during deposition.
	347 348	As-Welded or after stabilizing and stress-relieving heat treatment	347 348	

use this electrode selection chart when you are

Arc Welding 27 Types of Stainless Steel With 18 Different Coated Electrodes

by W. E. McFEE, *product information service, Armco Steel Corp., Middletown, Ohio*

IN BRIEF: Proper electrode selection, good joint preparation and correct welding procedures give quality welds in stainless steels.

WHEN YOU ARC WELD stainless steels flux-coated electrodes shield and protect the molten metal from the atmosphere, prevent oxidation of chromium, and produce strong corrosion-resistant welds. The flux also helps stabilize the arc and flows metal evenly into the shielded area. Other advantages of coated electrodes: superior penetration, less weld metal used, faster welding, weld deposit relatively free of inclusions.

Several things to remember for good stainless welds: Remove all slag after every pass. Use an electrode low in carbon, a flux free from undesirable carbon elements. Pick an electrode and procedure to suit the joint you are going to weld. The accompanying tables will help you.

Metal arc welding is preferred for welding stainless steels 20 gage and heavier because it is faster and reduces distortion and buckling. However, arc welding is less suitable for light gage because it is difficult to keep the penetrating arc from burning through. With proper tooling and copper chilling adjacent to the weld the oxy-acetylene and inert arc process is better.

The alloy content of electrodes, as in gas welding, should be higher than that of the base metal to compensate for expected alloy loss. Moreover, when welding stabilized stainless steels, a columbium bearing electrode must be used for both the columbium (Type 347) and the titanium (Type 321) stabilized grades. Titanium is not used in the core wire, because it would be oxidized in the arc stream and absorbed by the slag. Chromium-nickel electrodes are often used in welding chromium grades, such as Type 410, because they provide a ductile weld metal.

Welding current: Direct and alternating current are used in arc welding stainless steel. Direct current and reverse polarity (electrode positive with work negative) gives deeper penetration and more consistent fusion.

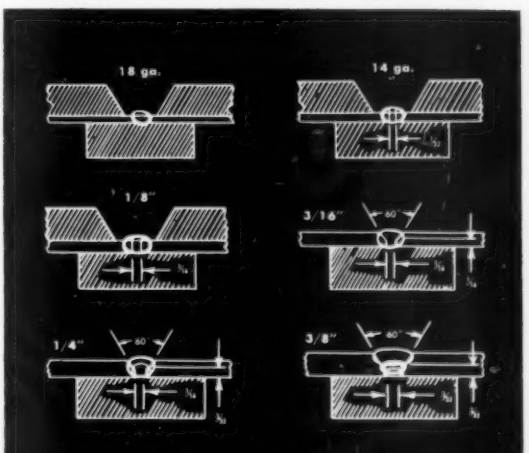
Since stainless steel has a lower melting point than mild steel, use at least 20 percent less current than you would for mild steel. Also the low thermal conductivity of stainless steel localizes the heat from the arc along the weld, again lowering current requirements.

You must clean scale, grease, and dirt from the material you are going to weld. Use any proven scale-removing and cleaning method.

Joint preparation: Stainless steel sheets, 18 gage and lighter, are butted without a gap. An accompanying table recommends gaps for heavier gage sheets and plates.

To reduce oxidation and porosity, keep the

continued on page 42

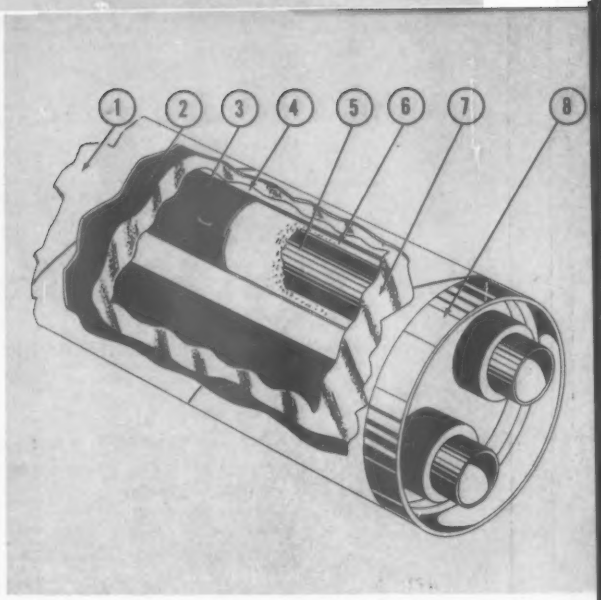


Material Thickness	Pass No.	Wire Size	Amps.	Arc Speed In./Min.	Arc Speed Ft./Hr.	Lbs. Electrode** Per Ft. of Weld*
18 ga.	1	5/64	45	15	75	.020
14 ga.	1	3/32	60	12	60	.038
1/8"	1	1/8	90	9	45	.08
3/16"	1	5/32	125	7	35	.150
1/4"	1 2*	5/32 3/16	125 160	6 8	17.5	.34
3/8"	1 2 3*	5/32 3/16 3/16	125 160 160	6 8 8	12	.51

Note: Copper backing up bar should be grooved approx. 3/16" x 1/16" deep.
* Use slight weave.
** 1/16" build-up maximum.

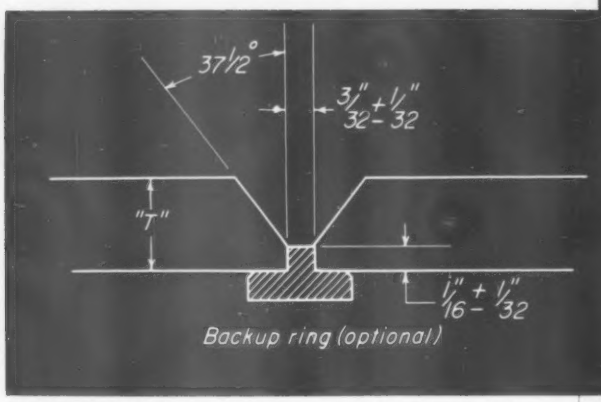
RECOMMENDED GAPS for heavier gage sheets and plates. No gaps are used on sheets under 18 gage.

this is the product



PARTS: 1-Pipe; 2-Insulation; 3-Asphalt felt; 4-Air space; 5-Conduit; 6-Asphalt; 7-Asphalt felt; 8-Collar.

this is the joint



JOINT DETAIL: Pipe ends are beveled 37½° either by machining or with portable flame cutting machines.

Dual Head Automatic Welds

IN BRIEF: An automatic manipulator which mounts both a submerged arc and inert arc head is gradually replacing manual pipe welding.

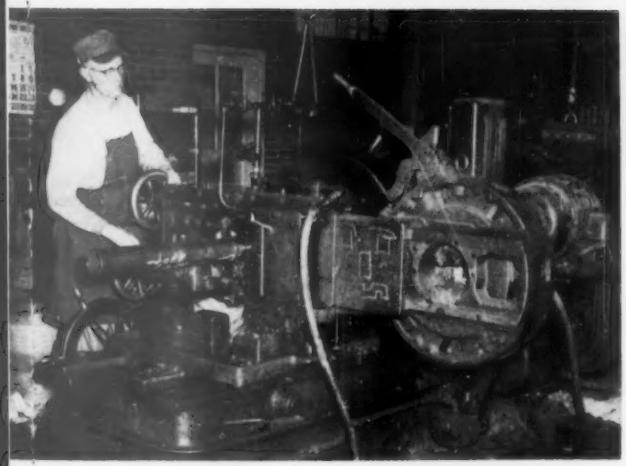
WHEN SMART CONTRACTORS install a piping system they save time and money by using prefabricated L, T, U, and Z sections made by Ric-Wil, Inc. of Barberton, Ohio.

At Ric-Wil their engineers have standardized on a 37½° bevel type weld joint. (See sketch). It serves them well, gives them good controlled welding procedures, keeps machine tool costs down, and cuts out a lot of paper work. Their weld specification calls for 100% inspection and everybody in the plant knows it.

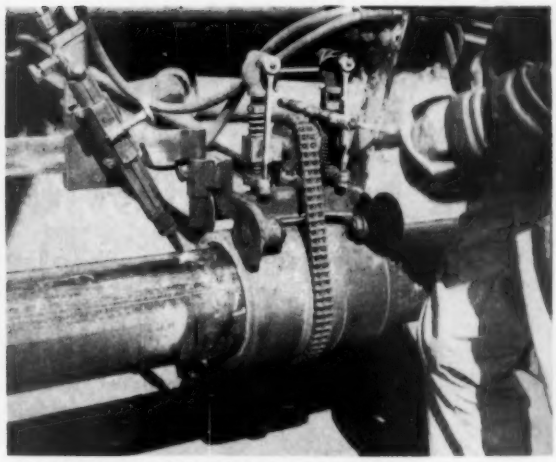
Here's what takes place in production from start to finish. For 95% of their welded products, they use mild steel pipe type A53 Grade B, and A106 Grade A. For the other 5% they use whatever the customer may specify. Pipe 4" in diameter and over is oxy-acetylene flame cut and beveled with a portable cutter. The company finds this tool handy, because it cuts and bevels pipe in one operation. It cuts at about 5 inches per minute; oxygen and acetylene settings are 75 and 10 pounds respectively.

In the fit-up area the pipe is placed in the exact position in V racks. Once they welded all piping manually, they now tack and weld root passes with E 6010 electrodes in preparation for automatic welding.

Ric-Wil is all for automatic welding. They use a manipulator consisting of two columns and two separate booms mounted on one track.

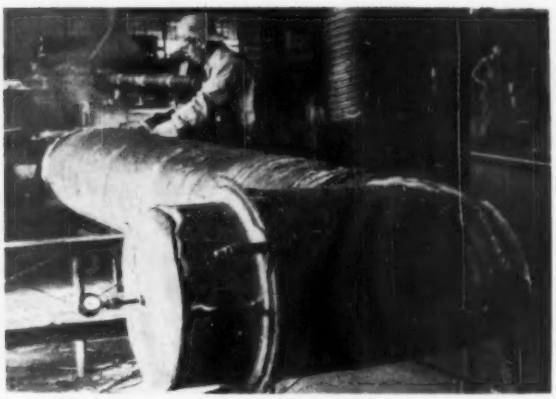


PIPE DIAMETERS under 4 inches are cut to length and beveled for welding in this pipe machine.



LARGE DIAMETER PIPE (over 4 inches) is flame cut to length and beveled in one portable, powered operation.

DOUBLE BOOM MANIPULATOR welds big pipe by submerged arc on one end, small pipe by inert arc on other.



SOAP TEST under 15 lb. air pressure tests sealed cover assembly made of gas welded corrugated conduit.

Pipe Assemblies

One boom carries a submerged arc head, the other, an inert arc head.

In welding pipe automatically, each head serves a special purpose. For diameters greater than 4" the submerged arc method produces good quality, high deposition rates, and lower costs. Inert arc is better for pipe 3" and under. When they tried submerged arc on pipe under 4" they had trouble with weld metal spillage, burn through, and slag removal. The submerged arc process uses a 750 ampere DC motor generator. The inert arc process, a DC rectifier machine.

Welding procedures: The company's specifications for automatic single and multiple pass welding are: positive electrode, 350 amperes, 30 volts, with 1/8" mild steel wire. In multiple pass submerged arc welding the operator chips slag as the part rotates. For inert arc the specifications are: DC straight polarity, 300 amperes, 30 volts, 1/16" mild steel wire and argon flow between 20 and 25 cfh.

All welded pipes are tested hydrostatically. Water pressure ranges from 300 to 600 pounds.

To protect and insulate, they first cover the welded pipe assemblies with fiberglass, or other types of thermal insulation. They then slip on an asphalt coated corrugated steel conduit, fitting the mitered joints. They weld this joint with oxy-acetylene process. They prefer it to arc welding, because in one operation it burns away the asphalt, cleans the conduit surface and helps avoid burn-through at the joint.

The insulated assembly is then tested by temporarily sealing the conduit ends, applying 15 pounds air pressure, and soap testing each weld joint. If leaks are found they are repaired.

Then comes final inspection, one of five inspections that assures the customer of a unit of high thermal efficiency and durability. • •

At Rocketdyne . . .

Welded Rockets Are Inspected With Magnetic Particle

IN BRIEF: A highly portable permanent magnet yoke allows thorough in-line magnetic particle inspection of thrust chamber band welds.

MAGNETIC PARTICLE INSPECTION is saving 8 hours on every rocket engine thrust chamber produced by Rocketdyne, a division of North American Aviation, Inc., in Slauson, California. The engines propel ballistic and intercontinental missiles, best known as Redstone, Jupiter, Thor, and Atlas.

Butt welds in girdle-like steel bands circling the thrust chambers must be perfect. Bands keep things in shape by resisting terrific outward forces.

Rocketdyne formerly inspected these welds with x-ray; it was thorough, but slow—each thrust chamber had to be pulled off the production line, x-rayed, then returned to the line. So metallurgists of the Production Development Lab worked out procedures for inspecting the welds right on the line.

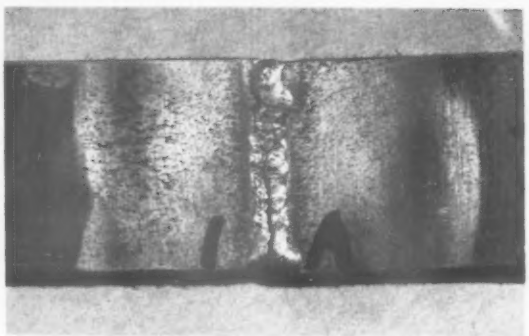
The procedure centers on the use of powerful, lightweight permanent magnets joined by a flexible handle to form a yoke. The self-contained yoke creates a magnetic field across the weld being inspected. Breaks in the magnetic field, caused by hidden defects, attract iron oxide powder sprinkled over the weld area, clearly outlining the defect. The method is fast, efficient, and economical. It saves 30 minutes of inspection time on every weld.

The yoke has a pull of 58 pounds. Rocketdyne metallurgists insist on at least a 40-pound pull for thrust chamber work. Another precaution: yoke magnets are never used closer together than 8-inches.

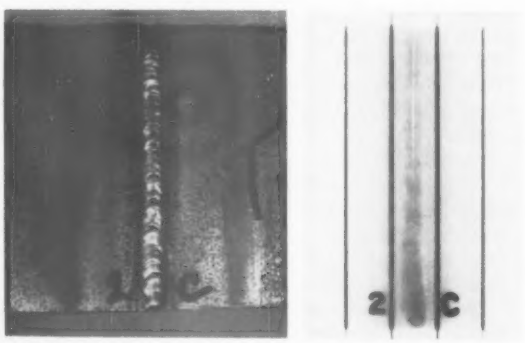
X-ray is still used to double-check magnetic particle inspection when indications are doubtful. But verification has only been needed on about 3 percent of the welds, a precaution that could be eliminated completely if the engineers would rework doubtful welds without rechecking them.

The magnetic particle method is powerful enough to check weld quality clean through. (Band material is never thicker than 0.090 inches). Both surface and subsurface defects

continued on page 42



97% OF DEFECTS found on band welds are as sharply outlined with magnetic particles as is this surface crack.



ONLY 3% are questioned. This weld has a fuzzy particle pattern, showed incomplete penetration on x-ray (right).

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4 oz. LIGHTER

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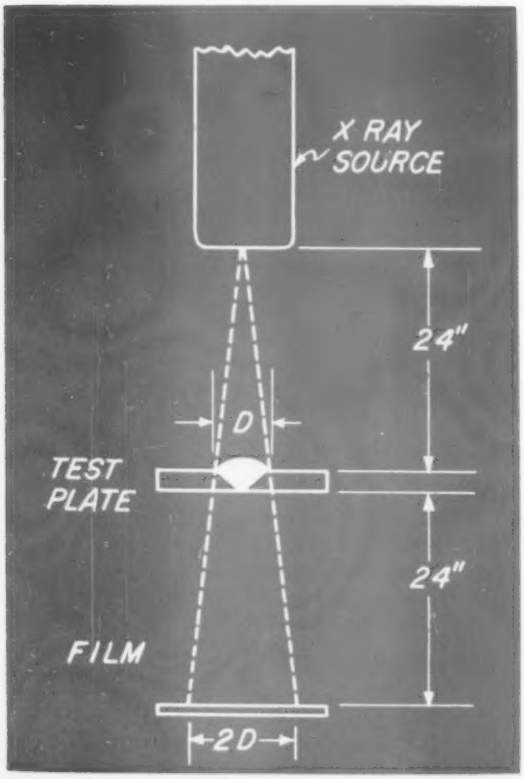
If you need flexibility for a wide range of radiographic inspection . . .

Use Both Gamma And X-Ray Equipment

TABLE OF TYPICAL EXPOSURES		
WELD THICKNESS	2 inches	6inches
FOCAL DISTANCE	14inches	36 inches
SOURCE OF RADIATION	10 Cu Co^{60}	2MEV X-Ray
EXPOSURE TIME	3Min.	2Min.

TYPICAL EXPOSURES for 10 Curie power source of Cobalt 60 and for 2-million electron volt X-ray generator.



MAGNIFICATION radiography doubles the size of welds on radiographic film, permitting a closer examination of weld qualification tests.

IN BRIEF: Gamma and X-Ray equipment complement each other at American Chain & Cable Co. They are used to inspect welds, qualify welding operators and test valves and castings.

Both X-ray and gamma ray equipment are used at American Chain & Cable Company's Reading, Penna., plant. Officials and operating personnel feel the combined use of these two radiographic processes give the flexibility needed for a wide range of work: inspection of welds, qualification of welding operators and testing of valves and castings.

The company uses a 2-million electron volt X-ray generator on sections from two- to 12-inches thick. Gamma ray equipment with a 10 Curie power source of a radioactive isotope (Cobalt 60) is used on sections less than two-inches thick.

The chart at left shows how these two inspection processes complement each other. Company officials point out that using the 10 Curie source of Cobalt 60 on the 6-inch steel section at 36-inches focal distance would require 8 hours exposure time.

The company is using a recently developed technique — magnification radiography — to inspect welded test plates (see sketch at left). Welds are positioned exactly 24-inches from the source; the film is placed on the other side of the weld, again exactly 24-inches away. The weld is magnified twice on the resulting radiograph and sensitivity is increased. This allows inspection agencies a closer examination of weld qualification tests.

Whenever the company inspects circumferential welds, the job is done in a single exposure, using X-ray or gamma ray equipment.

The film is wrapped around the outside of the weld and the radioactive isotope is placed inside the geographic center. This exposes the entire weld in one operation. When X-ray equipment is used, the generator's 30-inch lead cone is removed, allowing 360° radiation which exposes the weld all at once. • •

NEXT MONTH: Industry & Welding *brings you an up-to-the-minute report on nondestructive testing and inspection methods and techniques. This information-packed report will tell you how to use and where and how to buy equipment for X-ray, gamma ray, magnetic particle, penetrant and ultrasonic inspection.*

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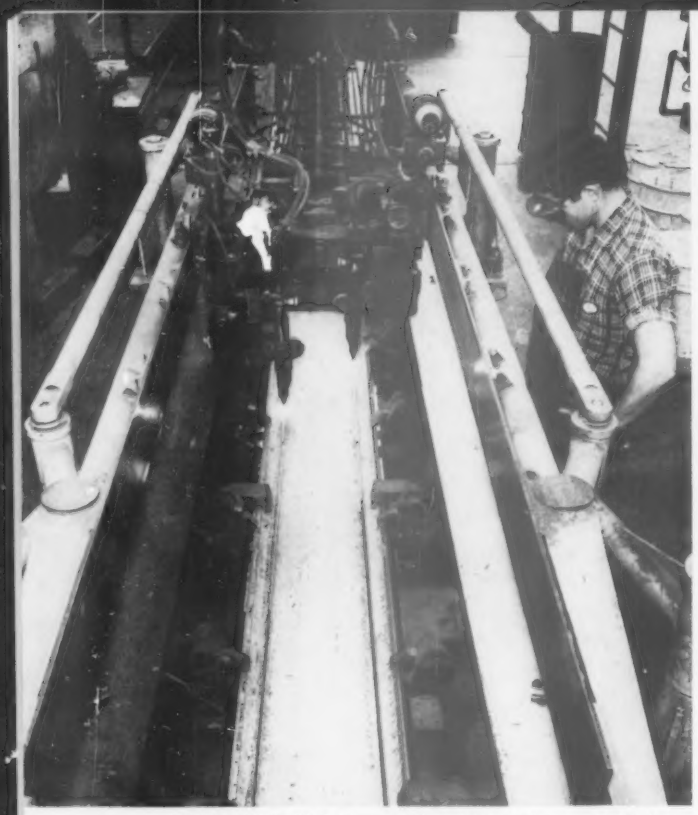
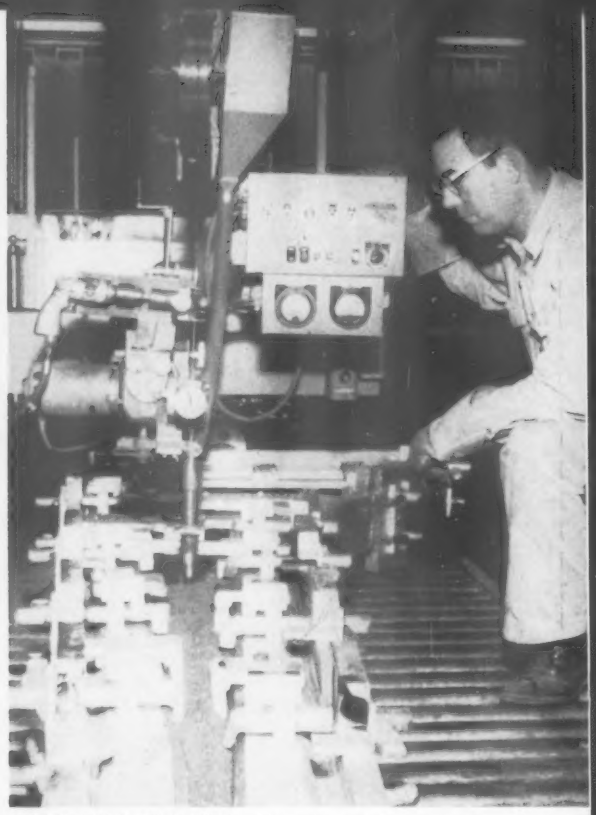


FLAME CUTTING is speeded up by template-controlled automatic machine.



AUTOMATIC WELDING with submerged arc equipment makes welds in one pass.

High-Strength Welded Fabrications

IN BRIEF: Rohr uses low-alloy high strength weldments because they usually cost and weigh less than machined forgings; design changes and production scheduling are easier, too.

LOW-ALLOY HIGH STRENGTH weldments are replacing more and more forgings at Rohr Aircraft Corporation, Riverside, Calif. Company officials feel weldments have "producibility, manufacturability and reliability" that are necessary for speedy deliveries at low cost. This means there are four reasons for using weldments:

1. Weldments usually cost less than machined forgings. They are comparable in strength and usually weigh less.

2. Design changes are easier in weldments than in forgings. With weldments, changes can be made during production. With forgings, changes are usually prohibitive.

3. Production scheduling is easier. Rohr can give more accurate estimates on delivery dates —and meet them.

4. Tieing up heavy machine shop equipment is no longer a problem. When weldments do contain forgings, these are small and easy to machine.

Rohr feels that low alloy steels (they oxidize rapidly above 600°F) can be used successfully in the lower ranges of temperatures where stainless steel are usually used—if they are suitably protected. The company is currently conducting experiments on protective surface treatments which could extend the use of low alloy steel weldments in such applications.

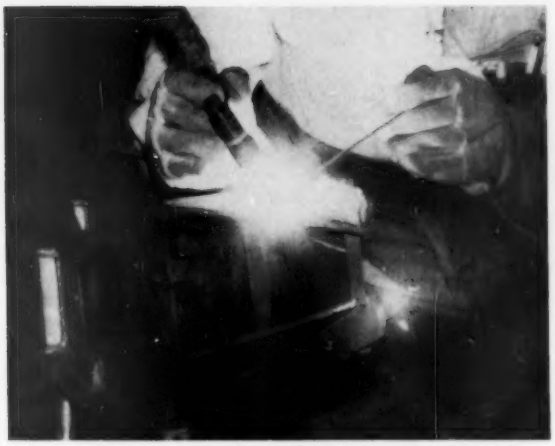
Here's how Rohr handles these weldments when they're made by metallic arc welding. They are made from AMS 6434 steel and joined by AISI 502 low hydrogen-type stainless steel electrodes. These electrodes are smooth-running and give porosity-free deposits with satisfactory physical properties.

Rohr's welding machines have foot controls for instantaneous control of welding current. This permits increasing amperage at the start of a bead for a smooth tie-in. It also permits decreasing amperage at the end of the bead to fill the crater.

Starting tabs are required on all butt joint

FOOT CONTROLS on welders give operators instantaneous control of welding current.

aircraft design changes are making a place for low-alloy high-strength weldments



ROOT PASSES are often made with tungsten inert arc welding process.

Replace Aircraft Forgings

welds to eliminate starting porosity and to provide a place to strike the arc and start the bead ahead of the joint. Backing strips are sometimes used as starting tabs by extending them slightly past the joint.

Welding fixtures and holding equipment are designed to permit most welds to be made in the flat or downhand positions.

Prior to welding, holding fixtures and parts are preheated at 350°-450°F by putting them in an oven or heating them over a bank of gas furnaces. This reduces thermal shock and prevents embrittling of the weld area.

Welding is done according to pre-determined sequences. These are carefully spelled-out for operators who follow them religiously. When multi-pass welds are required, each weld bead is cleaned thoroughly by grinding or other suitable means before another pass is made. If welding is interrupted before completion, the part in its fixture is held in an oven to maintain the preheat temperature until welding can be resumed.

Correct joint design is important because it helps control distortion, minimizes residual stresses, keeps quality standards high and promotes economy.

Service conditions are important factors affecting joint design. For instance, weldments subject to corrosion or erosion must have welded joints with minimums of surface irregularities, crevices or other conditions that would increase susceptibility to attack.

Consideration is given to the manner in which loads are applied, whether in shear, tension, torsion or bending. Certain joint designs are applicable for loads in one direction while others are suitable for varied and unpredictable stresses. It is also known that static or dynamic loading requires different joint design.

Present methods call for inert gas welding on fillet weld joints and metal arc welding on butt welded joints. The butts are square, or grooved with a V-preparation. The butt welds generally involve complete penetration with backing.

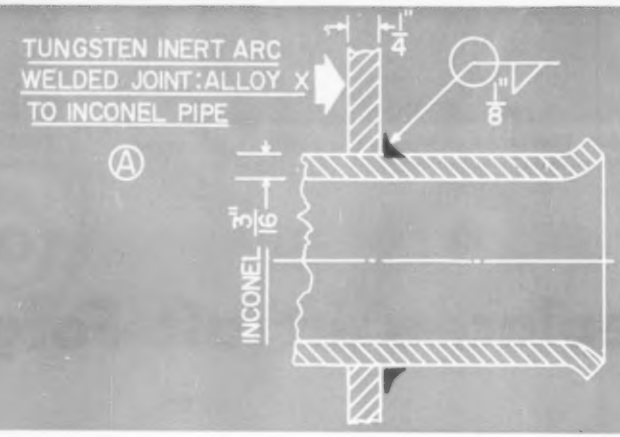
Square groove joints welded from one side with backing and complete penetration are suitable for all types of loading. This joint is satisfactory for materials up to 3/16-inch thick with

continued on page 50

JOINTS BETWEEN "Hastelloy" alloy X and Inconel are inspected (A). See sketch "A" below for complete joint details.

IN BRIEF:

Careful joint preparation, correct welding techniques and a special electrode are used to weld this high temperature alloy to Inconel, to mild steel and to itself.



Welding Hastelloy Alloy X To Inconel And To Mild Steel

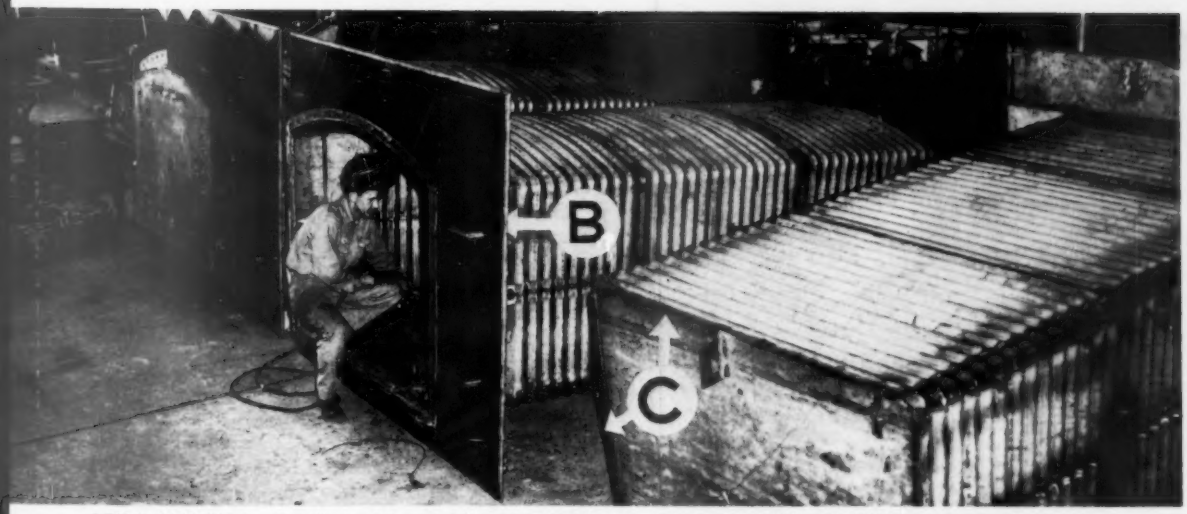
by **CARL JOHNSON**, *Alloy Engineering Co., Berea, Ohio*

WELDING HIGH TEMPERATURE ALLOYS is an everyday occurrence for manufacturers of furnace retorts. Construction frequently calls for welded joints between parts having different alloy compositions, between alloy parts and mild steel and between parts of the same alloy content.

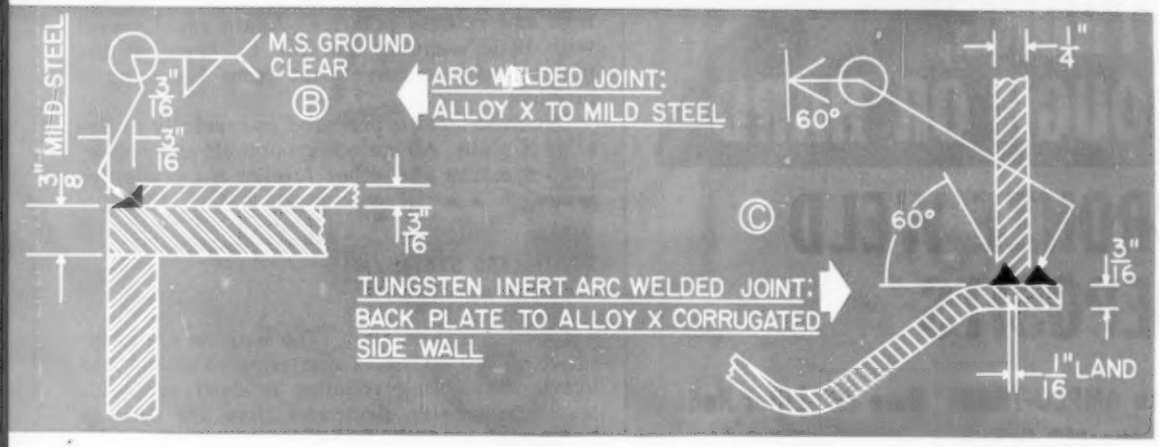
An example is three large furnace retorts made recently by the Alloy Engineering Company, Berea, Ohio. Placed in standard furnaces, these gas-tight retorts provide a controlled atmosphere chamber where honeycomb sections are brazed at temperatures up to 2000°F. These retorts were made from "Hastelloy" alloy X, a nickel-base metal with exceptional strength and oxidation resistance at temperatures up to 2200°F. Developed by Haynes Stellite Company, division of Union Carbide Corp., this alloy has good welding and forming characteristics. Unusual resistance to oxidizing, reducing and neutral atmospheres make it ideal for use in furnaces.

Besides welding the alloy to itself, Alloy Engineering had to join it to another nickel-base alloy — Inconel — and to mild steel. Here's how it was done:

Alloy X to itself: All welds are fillets or bev-



OTHER WELDS join alloy X to mild steel (B) and to itself (C). See sketches "B" and "C" below for details.



eled butt joints. Butt joints with no bevels could give complete penetration, but the extra heat required would have caused deformation.

Keeping welding heat down is important. It's done to prevent excessive heat from building up in the joint area and causing distortion. (The alloy has a lower thermal conductivity than steel.)

Heat input is kept down by using low amperages and high travel speeds with as little weaving as possible.

Welding is done with the tungsten arc inert gas shielded process. A ⅛-inch diameter cold drawn wire is used at 125-150 amps direct current and straight polarity. A ⅛-inch diameter one-percent thoriated tungsten electrode ground to a pencil shape gives good arc stability and holds up best. Argon shielding gas flows at 25-30 cfh.

Typical welds include the one joining the 3/16-inch corrugated side walls (double Vee butt joints) and the one joining the side walls to the ¼-inch back plate (see sketch). A back-up box containing argon is used on the former.

The alloy X sheets are sheared and formed before welding. The sheared edges are ground back 1/16-inch. This is done for three reasons: to get rid of stressed materials (shear drag), to get good joint fit-up and to clean welding surface (and adjacent areas) down to bright metal before welding. Scrubbing with a degreasing solvent removes grease, crayon marks and other foreign materials.

Alloy X to Inconel: There is only one difference between the welding procedures and techniques just described and those used to join alloy X furnace doors to nickel-base Inconel piping (see sketch). In this case, a filler rod developed specifically for joining dissimilar metals was chosen. International Nickel's Inco-Weld "A" was used. A ⅛-inch diameter bare

continued on page 42

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HASTELLOY ALLOY X

continued from page 41

rod was used. This type of rod is used on a wide variety of dissimilar alloys, including austenitic and ferritic stainless steels, low alloy steels, mild steels and high nickel alloys. It is said to produce welds with mechanical properties that compare favorably with those of the base metal.

Several things are done to keep heat input low. First of all, joint geometry is important. The ⅛-inch fillet welds used join ¼-inch alloy X to 3/16-inch wall Inconel pipe. The mass of these relatively thick sections drains off the welding heat and prevents distortion. Secondly, welds are made in a single pass.

Alloy X to mild steel: Again the special International Nickel alloy is used — this time as a 5/32-inch diameter coated electrode. It is used to make a typical weld: a 3/16-inch fillet joining alloy X retort shell to a ⅜-inch mild steel flange (see sketch).

Welding is done at 80 to 100 amps direct current and reverse polarity. Again rapid travel with little weaving and the thickness of the plates keep excessive heat from becoming a problem.

The mild steel is prepared as carefully as the alloy X plate. All scale is ground off and grease, crayon marks and other foreign materials are removed. • •

STAINLESS STEEL

continued from page 31

arc as short as possible. Too long an arc is inefficient and increases spattering. Vertical and overhead welding requires a short arc with smaller diameter electrodes than are used in horizontal welding. Porosity may be caused by moisture in the electrode coating, so bake the electrodes for a short time at 200°F or more to prevent it. Do this when in doubt.

After welding, completely remove all slag, scale and discoloration from the weld bead and adjacent base metal. Remove light weld discoloration electrolytically or chemically. Scale or oxide is best removed by grinding, pickling, or sandblasting. After grinding, refinish with progressively finer grits. The smoother and cleaner the surface of any stainless part, the better it resists corrosion. • •

MAGNETIC PARTICLE INSPECTION

continued from page 34

can be detected — cracks, porosity, and lack of fusion.

The key to any quality control procedure is interpretation. Rocketdyne has trained and certified four inspectors who can tell a real defect indication from a false one (like a surface irregularity that traps magnetic powder). This skill keeps production rolling. • •

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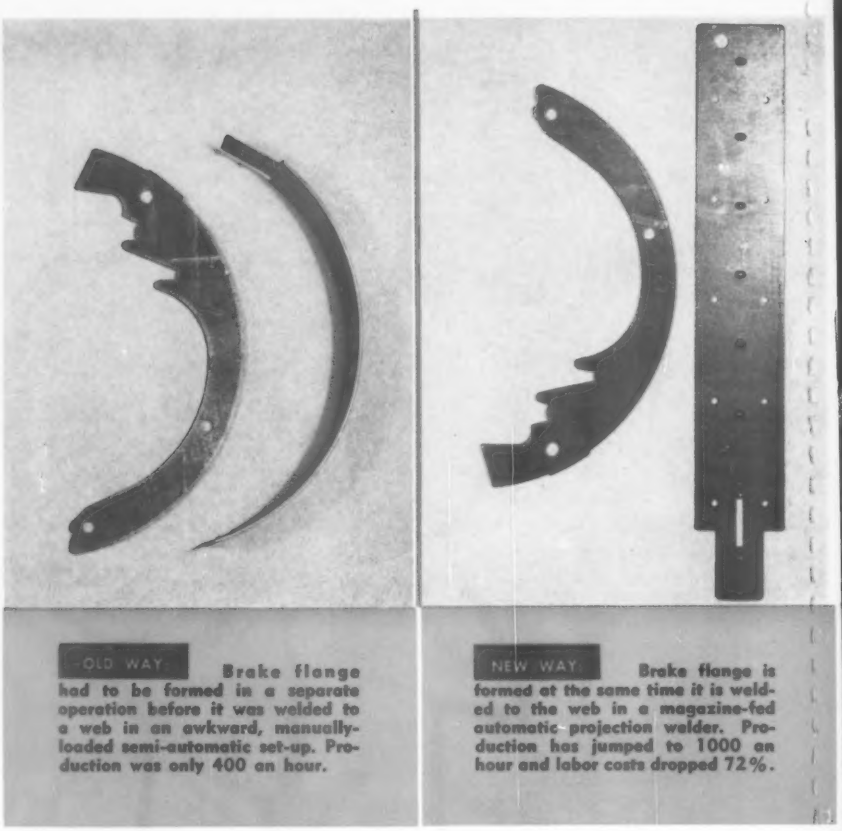
production went up 150% and costs dropped 72% when this firm did . . .



OLD WAY: **Brake flange had to be formed in a separate operation before it was welded to a web in an awkward, manually-loaded semi-automatic set-up. Production was only 400 an hour.**

NEW WAY: **Brake flange is formed at the same time it is welded to the web in a magazine-fed automatic projection welder. Production has jumped to 1000 an hour and labor costs dropped 72%.**

Automatic Resistance Welding And

IN BRIEF: An automatic projection welder replaced an awkward, manually-loaded semi-automatic set-up. It did away with a separate forming operation and boosted hourly production from 400 to 1000.

AUTOMATIC RESISTANCE WELDING has two big advantages: First, the machine does the work; it requires no attention from an operator. He only has to keep the feed magazines loaded. Secondly, some metalworking operations, such as forming, can be done simultaneously.

Wagner Electric Corp. knows this. A manufacturer of passenger car brake shoes, this St. Louis, Missouri, firm now makes them in a special automatic projection welder. The machine replaced an awkward manually-loaded and manually-operated semi-automatic projection welding set-up; it also did away with a separate forming operation. Result: Production increased 150 percent: from 400 to 1000 units an hour. Labor costs were cut 72 percent, including cost of a separate radius rolling operation.

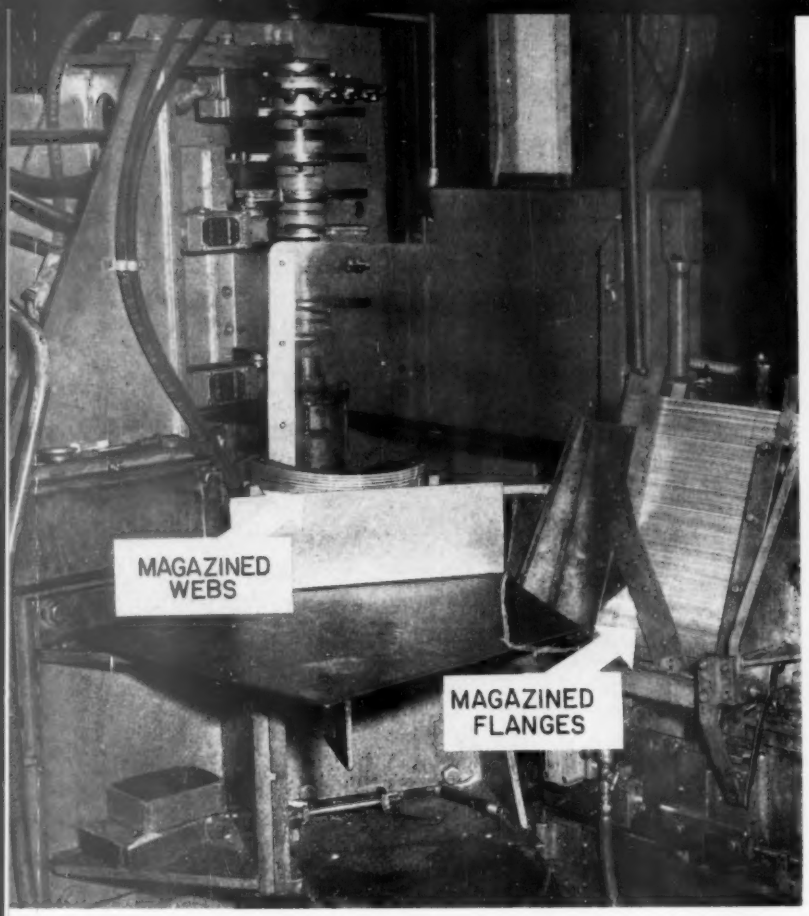
The weldment: Brake shoes are made from two steel stampings: a semi-circular .187-inch thick web and a .074-inch thick table (which we'll call a flange) to which brake linings are fastened. This strap-like flange has .060 inch high stamped-in projections (nine in a typical brake shoe) by which it is welded to the webs.

The old way: A drum-type projection welder used caused four distinct headaches:

1. Flanges had to be roll formed to fit the semi-circular webs. Face it, this extra operation cost money.

2. The 400-an-hour production was too slow: the machine could handle only two brake shoes at a time. And, the operator seemed to do most of the work. First, he picked up two webs and positioned them in the welder. Then, he picked up two formed flanges and spotted them on top of the webs. Next, he had to press two palm buttons to start the welding cycle.

Finally, the machine got into the act. Webs and flanges were clamped together and welded. Nine separate welds were made in a pair of assemblies. But, only one at a time in each. It



MAGAZINES which hold 100 parts each, automatically feed in webs and flanges.

CIRCULAR ELECTRODE does the welding.

Forming In One Operation

was a case of weld-index . . . weld-index . . . weld-index.

3. Housekeeping was a problem. Formed flanges are bulky. They need a lot of tote boxes to store them. This hurt because storage space around the welder is limited.

In addition, a helper has to keep bringing up full boxes so the welding operator can get at them. And, the helper has to keep taking away the full boxes. Finished parts are ejected automatically from the machine into the boxes, but usually wind up all over the floor.

4. Continuous indexing wore out more clutches than you'd care to think about. Each time one was replaced, the welder was shut down and production stopped.

The new way: Wagner bought a special vertical automatic projection welder. It eliminated the four headaches just mentioned. How? Like this:

1. The forming operation is no longer needed. The machine forms the flanges as it welds them to the webs.

2. Automatic welding is faster. Once the machine is turned on, the operator only has to keep feed magazines loaded with webs and flanges. The machine does the rest—automatically. And, there is no indexing.

3. Housekeeping is a cinch. Because flanges are now flat, more of them can be stored in fewer tote boxes. Storage space is not a problem.

And, the helper is eliminated. The operator himself brings parts to the machine and loads them without any help. The machine also ejects parts after welding. It puts parts on a conveyor which leads to a washing operation.

4. Welding is continuous. No indexing means no clutch replacement and downtime.

How it is done: Webs and flanges are loaded into two separate 100-piece capacity feed magazines. These feed parts automatically into the welder.

Welding is done between a circular fixture on one side and a circular electrode on the other. The fixture holds two webs and rotates them counterclockwise. The one-inch thick 14-inch diameter copper tungsten electrode rotates

continued on page 48

THE POURING PIN releases a flood of superheated steel into the weld cavity of this big part.

Thermit Welding Salvages 25-Ton Mill Parts With 3,200 Lb. Weld

IN BRIEF: The quickest and cheapest way to repair very thick parts is to thermit weld them. Ignited thermit powder converts to free iron for pouring into the weld cavity mold.

THERMIT WELDING isn't used much compared with other methods, but The Timken Roller Bearing Company of Canton, Ohio would be lost without it. Their Gambrinus Mill maintenance shop finds thermit welding excellent for repairing broken or worn mill rolls, gears and pinions. All big, they would cost thousands of dollars and months of waiting to replace them.

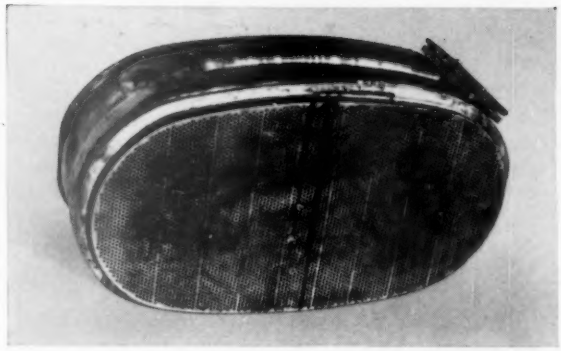
Take the largest job they ever thermit welded, a 25-ton sow block that needed a 3200 lb. weld. Box after box of welding electrodes could have been poured into the joint. Reels of automatic wire could have been fed into it. Labor would have been sky high, post heat-treatment unavoidable. Thermit welding did the job and did it in 30 percent of the time the arc would have taken.

The thermit reaction, according to metal handbooks, is an "exothermic, self propagating process". This means: a mixture of finely divided aluminum powder and iron oxide is ignited, then chemical reduction converts it to aluminum oxide and free iron. The process needs no cables or power supply. A chunk of red hot metal triggers the reaction, which is over in only a half minute.

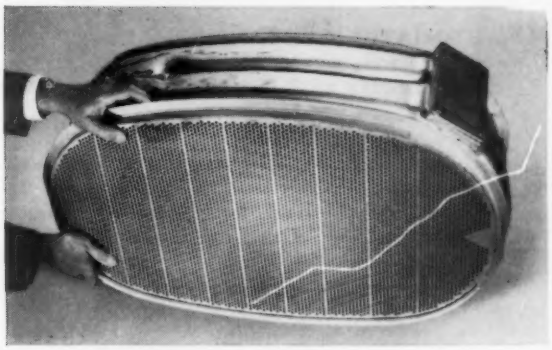
Let's study a typical Gambrinus job. A herringbone gear cast integral with its shaft from their 10-inch mill broke. The diameter of the shaft was 9 inches, total weight, 1½ tons.

They sawed off the broken end and bored its center to take a 1-inch steel line-up pin. Then they bored a slightly oversized steel replacement blank and lined up the two parts an inch apart. The gear was set on firebrick on a large steel plate. They aligned and supported the blank with a scrap plate tacked to its end. Lin-

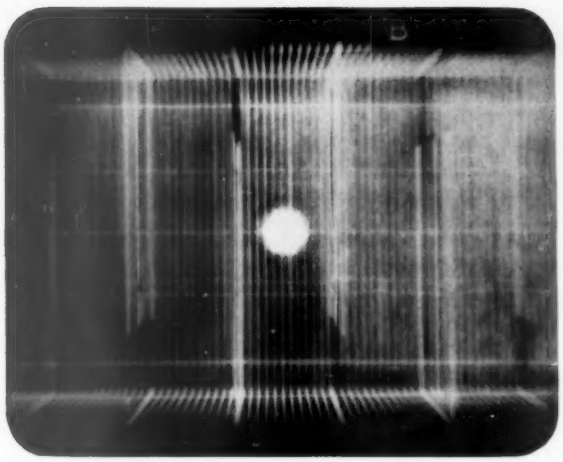
continued on page 48

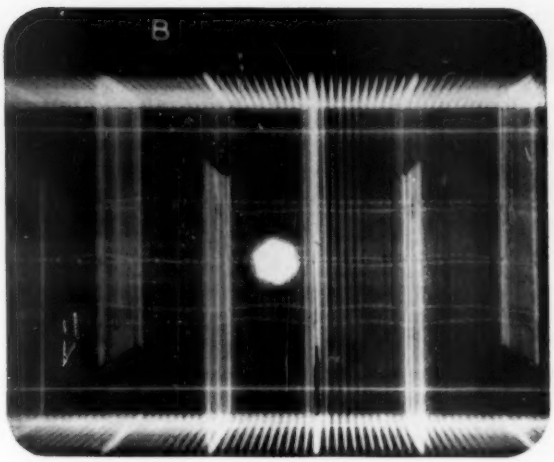


An oil cooler as it comes from the airplane engine. Radiograph below shows accumulations of sludge and dirt on the tubes.



After cleaning, the oil cooler is ready to return to its job. Radiograph below shows dirt gone and passages unrestricted.





To keep an engine's bloodstream clean

OIL COOLERS are vital to today's aircraft engines. At overhaul time they must go back on the engine clean as new. No minute particles of carbon or metal can remain to be a threat to the renewed engine. Cleaning them has become a specialty with SMS Instrument and Accessories Corp. of Idlewild Airport, N. Y. C.

To show that each cooler they clean is free of debris, it is sent to Industrial X-ray Incorporated, New Hyde Park, New York, to be radiographed. And when the cooler goes back to its job, its x-ray certificate of cleanliness goes with it.

In such inspections of assemblies, in quality control, in nondestructive testing, radiography provides a means of "seeing" internal conditions and also a lasting record of what is seen.

Producers of castings, and makers of welded products, find radiography a means of expanding their business and making sure only high-quality work is delivered.

Would you like to learn how it could help you? Contact your Kodak x-ray dealer or the Kodak Technical Representative to talk it over.

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AUTOMATIC RESISTANCE WELDING

continued from page 45

clockwise. It's an R.W.M.A. Class 13 alloy with high strength and low conductivity.

Flanges are fed into the gap between the webs and the electrode with the projections facing the webs. They're fed in under constant pressure. Welds are made when projections are in welding position. An adjustable cam setup controls limit switches. These are synchronized to give welding pressure and current only when projections are in position for welding.

The first weld joins the flange to the web. Then the flange follows the web as it is rotated in the fixture. By the time all nine welds have been made, the flange has been joined to the web and has reached its ultimate semi-circular shape — without a separate forming operation. • •

THERMIT WELDING

continued from page 46

ing up took an hour.

Next, they filled the 1-inch gap between parts with molding wax. That took 2 hours. When the wax set they placed a metal box around the joint, and plugged the openings with sand and bricks. The box was rammed and gated so that the joint would fill from the bottom. A basin with a shrinkage head was formed in the mold top so that the alumina slag and the pipe would be confined there. Ramming and gating was a four hour job.

Holes were made in each side of the mold for preheating the joint area. Done with a torch, preheating does three important things: melts out the wax to form the weld cavity, dries and hardens the sand, and brings the weld area metal to the cherry-red heat needed for fusion. Absolute dryness is essential; an explosion would be certain without it. Holes are plugged after preheating.

They made the thermit crucible ready along with the mold, by cleaning and torch drying it. A stoppering pin was put into the pouring opening at the bottom, then the thermit powder was charged. The rule of thumb: 20 lb. of powder for every pound of wax. The herringbone job took 75 lbs.

Pouring: A crane holds the crucible over the pouring gate of the mold and a red hot piece of steel is thrown into the crucible. This starts the reaction, which lasts only 30 seconds. Then they pull the pouring pin and the superheated steel floods the weld cavity and fuses with joint surfaces to make the weld.

When cooled, the mold is stripped off the gear. Gates and risers are lopped off with a flame-cutting torch. The thermit weld outwardly is an exact duplicate of the wax buildup; inwardly, it's sound as a dollar and ready for heavy, continuous mill duty. • •

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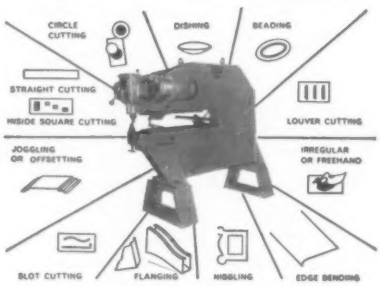

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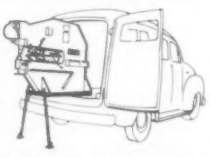

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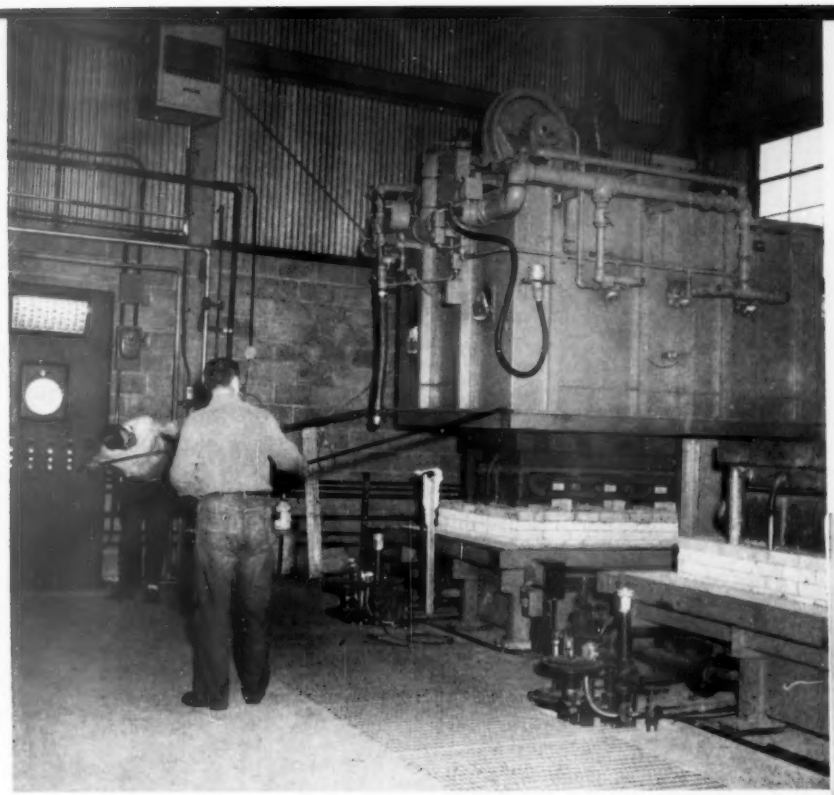
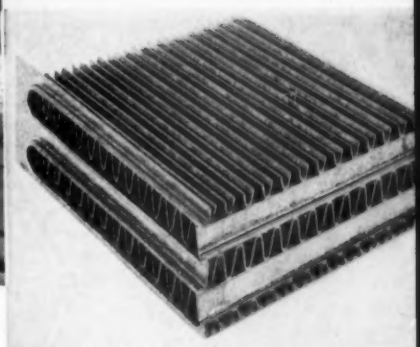


PROCESS: Moveable bell controlled atmosphere furnace is used to stress relieve cells and flow alloy over them.



PRODUCT: Cutaway of cell shows filleting between sheets and tubes. The protective coating covers all surfaces.

Furnace Brazing Of Intricate Assemblies

IN BRIEF: Intricate sheet steel assemblies fit for high temperature service, can be bonded and coated in one furnace brazing operation.

HIGH TEMPERATURE BRAZING and automatic shielded tungsten arc are key processes in the success of a heat transfer development introduced by the Griscom-Russell Company, Massillon, Ohio.

Using steel as the structural material and nickel base brazing alloys, plate fin cells are used for high temperature gas-to-gas heat transfer applications. Typical applications include: preheat of combustion air with waste flue gas, indirect air heaters, and special process heaters, coolers, or recuperators.

Each plate fin exchanger cell (any number of cells can be combined in a single unit) has three simple parts: a corrugated sheet (about .030″ thick), which is the extended surface; formed and butt welded flat tubes (about .040″ thick); and blanked plate tube sheets (usua'ly .1875″ thick).

The extended surface design assures efficient heat transfer. Inside each tube, in a typical case, the extended surface consists of several corrugated sheets, each measuring 20 inches across corrugations and 10 inches parallel to the corrugations. The extended surface between each pair of tubes consists of two corrugated sheets, each measuring 30 to 60 in. across the ½-inch high corrugations and 10 inches parallel to the corrugations.

Corrugated sheets are stamped on high speed presses, sheared to length, inspected and degreased. Then they are sprayed with a nickel-base brazing alloy on a conveyorized line. This is a two-coat process. The sheets are heated, coated, dried, recoated and dried in two trips through the line.

The tubes are formed from flat sheets with a 180 degree bend on one edge. Then they are butted in a fixture and the seams welded by automatic shielded tungsten arc. In another fixture, six of these tubes are edge welded to a tube sheet on each end, automatically.

The coated corrugated sheets are assembled inside and between tubes, then the cells are brazed.

Brazing is done in controlled atmosphere batch furnaces. The brazing temperature is 1950°F., with a heating cycle of about two hours,

continued on page 50

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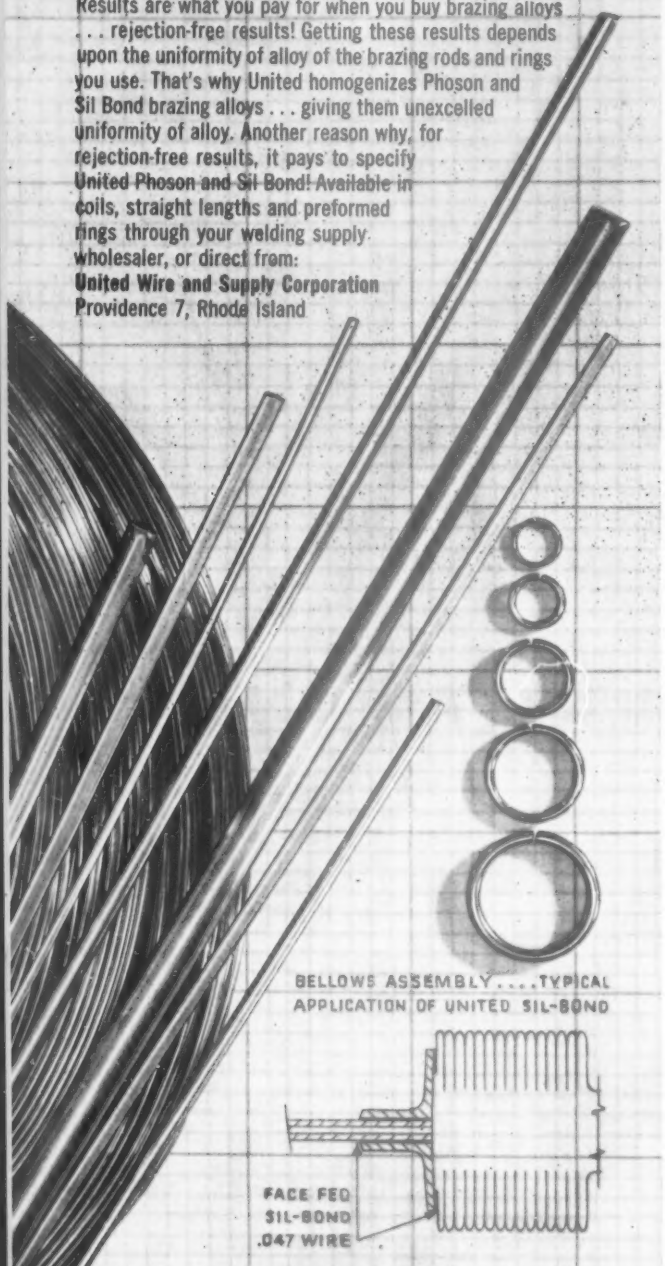

For silver brazing alloys . . . For aluminum, brass and copper wire and tube . . . always **Specify**

UNITED

FURNACE BRAZING

continued from page 49

a holding time of about 30 minutes, and a cooling time of approximately 8 hours. The furnaces have fixed bases, and Inconel retorts to hold the cells and contain the dissociated ammonia atmosphere. A movable bell fits on each furnace base and houses the charge. During brazing, the cells are completely stress relieved. The brazing alloy forms fillets, bonding the corrugated sheet to the tubes. It also forms fillets at the tube-to-tube sheet junction, backbrazing the welds for added strength and sealing.

The brazing alloy flows over all of the sheet metal to make a corrosion resistant nickel-base coating. The high temperature oxidation resistance of this alloy is much better than copper brazing alloys commonly used. • •

HIGH STRENGTH WELDMENTS

continued from page 39

adequate root opening. This particular design is economical to prepare.

Single V-Groove joints welded from one side with backing and with complete penetration are suitable for all types of loading with full strength obtainable. Welding can be done economically in thicknesses up to ¾-inch. This joint is desirable when welding can be done on one side only.

Double-fillet welded joints (tee or lap) give full strength under static loading with adequate sized fillets. These joints are economical to weld and require no special preparation. Maximum strength in tension on the lap joint is acquired when the lap equals five times the thickness of the thinner member.

The completed weldment is post heated at 350°-600°F prior to stress relief. It is then transferred to a holding oven or furnace for stress relief at 1200°F for a 20 minute minimum. This transfer is made before the weldment loses an appreciable amount of heat. This postheat treatment is used to prevent weld embrittlement and to remove stresses caused by expansion and contraction.

After stress relief, parts are transferred to salt bath heat treating furnaces for final heat treatment. This is preferred over atmosphere furnace heat treating because heating is done quickly and uniformly with minimum distortion. It also tends to clean the weldment.

Heat treated weldments give 180,000 to 200,000 psi ultimate tensile strength. There is every indication that the present design allowables of 120,000 psi ultimate and 80,000 psi limit loading for weldments can be increased by 19,000 to 40,000 psi.

Radiographic inspection completes the job. • •

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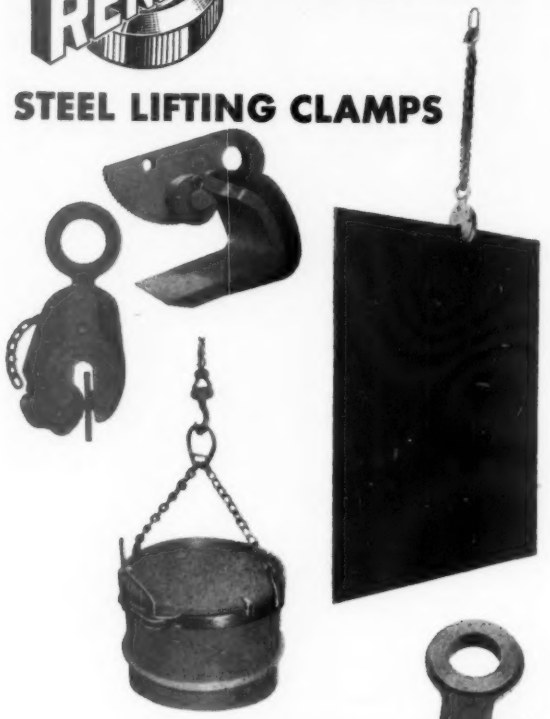

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Prior to being treated with HARD-N-TUFF, this high-speed drill could make only one hole through chrome and nickel casting 17/32" thick, before being redressed. After HARD-N-TUFF treatment, this same high-carbon drill was used 20 times, without redressing, for the same job.

These untreated spur gears lasted only about 1 month before wearing out. Now the gears, after treatment with HARD-N-TUFF, last at least 6 months.

Chisel made from ordinary 1020-1/2" drillrod, hardened with HARD-N-TUFF, cut rust-locked nut with 2 hammer blows. Cutting edge was completely undamaged.

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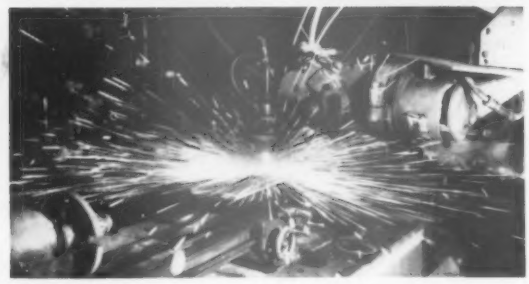
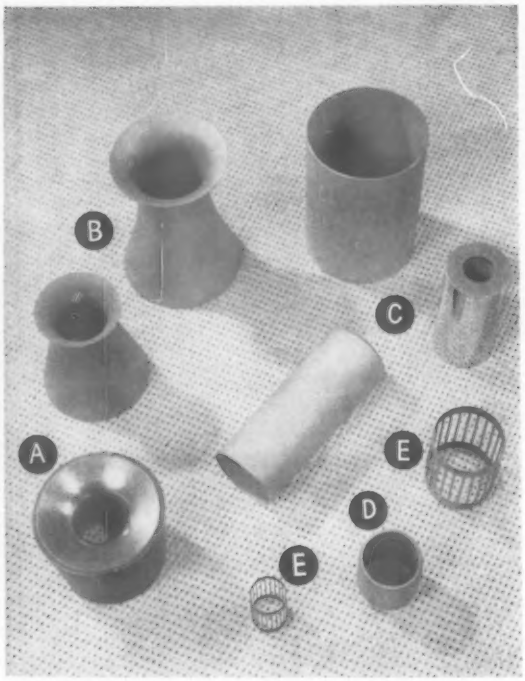


THE PROCESS: Powder- and wire-fed Plasma Arc Torches are available. Tungsten carbide powder is melted and applied to make nozzle liner for rocket engine (top). Wire-fed torch coats stainless steel on aluminum plate (bottom).



THE PRODUCTS: Rocket nozzle coated with pure tungsten (A); rocket nozzle liners of tungsten (B); tungsten and tungsten-coated tubes (C); crucible of pure tungsten (D) and gird cages of high-density tungsten (E).

Plasma Arc Torch Generates 30,000° F: Coats Metals At Supersonic Speeds

IN BRIEF: New torch makes possible coating of parts or fabrication of shapes with ultra-high temperature materials that will withstand heats up to 5,000°F.

ULTRAHARD MATERIALS that were just about unworkable now can easily be worked on a production basis with a new Plasma Arc torch that develops heat up to 30,000°F. According to the manufacturer—Linde Company, Division of Union Carbide Corp.—the torch makes possible the coating of parts or the fabrication of shapes with ultra-high temperature materials that will withstand heats up to 5000°F. It also can be used to cut metals.

Nearly everyone has heard about the Plasma Arc torch. (The Heliarc plasma jet for cutting aluminum introduced in 1955 was the first.) The most frequent questions are: How does it work? What is it used for?

Now available are two new plasma jet torches, small devices less than two inches in diameter. The two are the cutting torch and the plating or coating torch. In the cutting torch both the arc and the gas stream leave the nozzle and continue to the work. The new torch, the "non-transferred arc," is the latest development. It is used for plating and to fabricate parts.

How the torch works: An electric arc is forced into and through the nozzle and the gas keeps going. A substantial part of the gas flowing through the nozzle must go through the arc. The result is the highest controlled temperatures used in industry—up to 30,000°F. The gas velocities run up to several thousand mph, or the speed of sound.

Any gas or mixture of gases which does not

attack the tungsten cathode can be used in the jet torch. These include the rare gases, argon, and helium, plus nitrogen and hydrogen.

The surprising thing is that, in spite of the heats produced in the torch, the torch itself is not consumed. It isn't, because the arc column does not touch the nozzle. It is shielded from the arc column by a tube-shaped stream of relatively cool gas.

The choice of powder or wire is based on convenience and cost. Stainless steel is readily available in wire form and would most often be wire-fed.

On the other hand, the refractory materials, such as tungsten, tungsten-chrome alloys and others, usually come in the powder form and are used that way.

As the wire or powder metal enters the constricted arc chamber of the torch, wire or powder is melted by intense heat and the metal particles are then carried by inert gases to workpiece.

What is the Plasma Arc used for? It is said that most inorganic materials that melt without decomposing can be used in a plasma torch. Some of the materials are:

1. The refractory metals such as tungsten, tantalum, molybdenum, niobium and rhenium.

2. Some refractory metal compounds such as borides of zirconium, tungsten, niobium, tantalum, titanium and chromium.

3. The refractory carbides of niobium, hafnium, tantalum, zirconium, titanium, tungsten vanadium.

4. The refractory oxides of thorium, hafnium, magnesium, zirconium, cerium, aluminum.

5. The noble metals—platinum, palladium, etc., and their alloys.

Coating: It used to be very difficult to use these high temperature materials as coatings. The manufacturer says that it now can easily coat with these materials. The part to be coated is chucked and rotated. While it is turning, the coating is applied. The particles of metal are in a plastic state when they strike the part at high velocity. The coatings have an excellent bond. The bonds are generally chemical and mechanical, far exceeding these obtained by electroplating, vapor deposit, or metal spray.

Forming: Of particular interest is the use of the plasma jet for formed metal shapes such as parts for nuclear work, tungsten crucibles for metallurgy and thermocouples. They are made by depositing coatings to the required shape and thickness.

Cutting: To adapt the torch for cutting, Linde adds arc-concentrating nozzles. They stabilize the arc flame, concentrate the power and the momentum. The torches are unusually effective metal cutters, because they give a desirably narrow kerf and because they eject the molten metal effectively from the cut. • •

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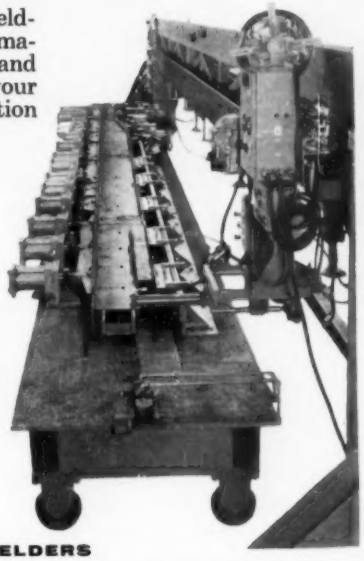

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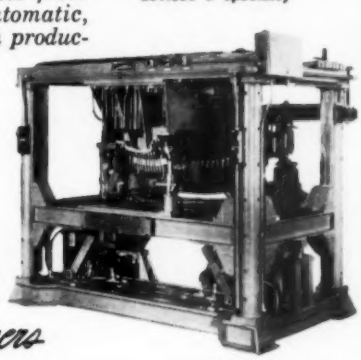

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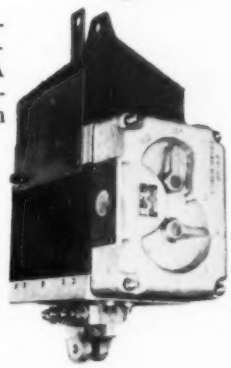

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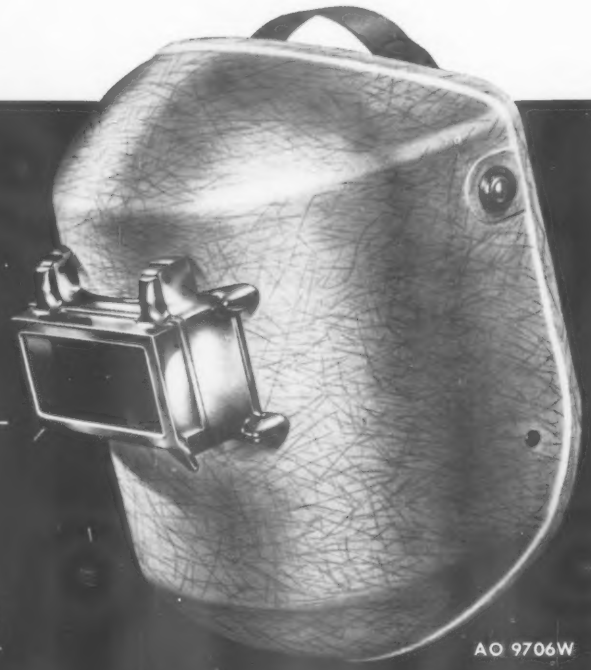

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AO 486A WELDERS' GOGGLE. New. Frame is soft, pliable, comfortable vinylite with a deeper cup and *better fit over the face and over all types of spectacles and Safety Glasses.* New nylon black adapter will not buckle or shrink with heat. Fitted with standard 50mm. rd. Noviweld or Filterweld lenses, shades 3, 4, 5, 6. Hardened lenses if desired. Recommended for acetylene welding, cutting, burning, brazing.

AO R5056 RESPIRATOR. Here's the respirator for all dusts not significantly more toxic than lead, pneumoconiosis-producing mists, chromic acid mist *and metal fumes not significantly more toxic than lead* such as produced in welding, burning or any operations where metals are heated to their melting point. Bureau of Mines Approval 2163.

AO 9X503. Whether it's gas or electric welding or burning this one-piece back, chrome leather glove with heavy black lining fills the bill. It's *very* serviceable hand protection. One-piece palm. Full leather cuff. Lining provides rigidity. All vulnerable seams welted.

See your nearest AO Safety Products Representative or write for literature.

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For More Information Circle No. 9 on Reader Service Card.

GUIDE TO SELECTION OF PROPER TYPE OF WELDING CURRENT

MATERIAL	DIRECT CURRENT DCSP	DIRECT CURRENT DCRP	ALTERNATING CURRENT
Aluminum up to 3/32	P	G	E
Aluminum over 3/32	P	P	E
Aluminum bronze	P	G	E
Aluminum castings	P	P	E
Beryllium copper	P	G	E
Brass alloys	E	P	G
Copper base alloys	E	P	G
Cast iron	E	P	G
Deoxidized copper	E	P	P
Dissimilar metals	E	P	G
Hard facing	G	P	E
High alloy steels	E	P	G
High carbon steels	E	P	G
Low alloy steels	E	P	G
Low carbon steels	E	P	G
Magnesium up to ⅛"	P	G	E
Mg over ⅛"	P	P	E
Magnesium castings	P	G	E
Nickel & Ni-alloys	E	P	G
Stainless steel	E	P	G
Silicon bronze	E	P	P
Titanium	E	P	G

P = POOR G = GOOD E = Excellent

use this current selection guide for . . .

Tungsten Inert Arc Welding

Second of a Series by **FRANK KUNCZ***

IN BRIEF: Both AC and DC power sources can be used for tungsten inert arc welding. Here's how to tell which one to use—and why.

IT IS NOT ABSOLUTELY NECESSARY to have a special power source for tungsten inert arc welding. However, specially designed machines—alternating or direct current types—are needed to get top quality and performance.

DC Welding

DC power sources—motor-generator or rectifier — offer a choice of straight or reverse polarity.

Straight polarity is most widely used. It is preferred on all metals, except aluminum, magnesium and beryllium copper. It gives deepest penetration per ampere of current, the narrowest heat affected zone, faster travel speeds and less distortion because of faster heat input.

Reverse polarity offers shallow penetration, a wide bead, superior oxide removal on oxide-forming metals like aluminum, magnesium and beryllium copper. A drawback is a tendency toward electrode contamination and a resulting need for operators with greater skill.

With equal DC welding currents, a larger tungsten electrode is needed with reverse polarity. For example, with 125 amps reverse polarity a $\frac{1}{16}$-inch diameter tungsten electrode can be used. With 125 amps straight polarity a ¼-inch diameter tungsten electrode is needed.

The reason? It's due to the direction of electron flow. With straight polarity, electrons flow toward the work. This puts more heat in the work than in the electrode and permits using a smaller electrode. Conditions are the opposite with reverse polarity. Heat flow is toward the electrode.

AC Welding

AC welding is a compromise between straight and reverse polarity welding with direct current. It gives high heat input during the straight polarity portion of the AC cycle (occurring each half cycle). During the reverse polarity portion gas ions hitting oxide layers give good cleaning action.

Although the trend in AC equipment seems to be toward AC with continuous superimposed high frequency (technically called unbalanced wave), there are balanced wave machines. These have a special circuitry which, through a

continued on page 56

**Formerly with the Lamp Wire and Phosphors Department, General Electric Co., Cleveland, Ohio.*

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the **ARC-TWIN**

Double Notches **Pipe and Tubing with** *Each Downstroke* **of Punch Press!**

PATENTED

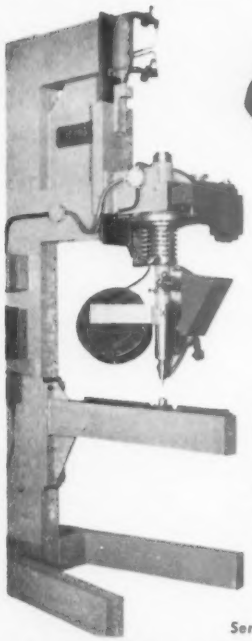
SAVING both time and cost, it gives you perfect T-joints—instantly ready for welding or brazing without deformation or finishing! Twin-acting punch shears clean, from inside out, leaving two matching notches (in perfect 180° alignment) with every downstroke of the punch press. Quickly interchangeable dies and punches accommodate pipe and tubing from ½" to 2⅜" O.D.; special units, up to 3" O.D.

Special Arc-Twins for double notching stainless steel or monel metal and units built to your specifications can also be furnished.

Ask for twin-notched sample of pipe or tubing.

VOGEL TOOL AND DIE CORPORATION
1819 North 32nd Ave. • Melrose Park, Ill.

...up to 150 accurate welds per hour!



production* SPUD WELDING *for

BARRELS • TANKS • HEADS
SHELLS • WATER HEATERS

This semi-automatic Peck development limits operator responsibility to "load-unload". It doesn't make mistakes. Makes circular welds on any flat surface. Also available with sequence control, with tracers or camming arrangements for use with saddle fittings.

Send drawing and detail for quotation!

CECIL C. PECK COMPANY
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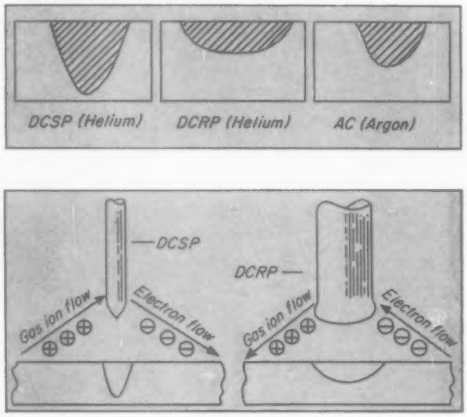
TUNGSTEN ARC WELDING

Continued from page 55

Alternating or direct?



DC STRAIGHT POLARITY gives deepest penetration per ampere of current (top). It also permits using a smaller tungsten electrode because electrons flowing toward the work take heat out of the electrode (bottom). With reverse polarity heat flow is toward the electrode and larger electrode must be used.

group of series capacitors, eliminates the need for continuous high frequency; nevertheless, high frequency is used to start the arc.

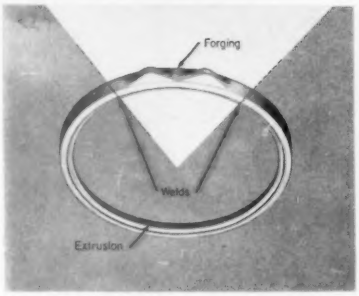
In the case of unbalanced wave machines, continuous high frequency is needed for arc stability. Therefore, if an AC transformer is adapted for tungsten inert arc welding, it must be coupled with a "missing link" high frequency unit. Transformers not designed for balanced wave can only be used at 70 percent rated capacity to prevent overloading the primary as a result of an inherent DC component.

Balanced wave offers the following advantages: deeper penetration in fusion area, faster travel speeds, better arc stability at all current levels and generally superior results in all phases of applications.

Any arc welding power source can be adapted for tungsten inert arc welding, but changes and additions must be made and certain precautions observed. Water and gas solenoids with appropriate time delay relays should be added. A high frequency oscillator is mandatory with an AC machine; it is desirable for starting DC equipment, but it is not mandatory. • •

NEXT MONTH INDUSTRY & WELDING *brings you an up-to-the-minute report on nondestructive testing and inspection methods and techniques. This information-packed report will tell you how to use and where and how to buy equipment for X-ray, gamma ray, magnetic particle, penetrant and ultrasonic inspection.*

HERE'S AN IDEA



FLASH BUTT WELDING an extruded section to a forging replaced a formed and welded rectangular bar as . . .

Ingenuity cuts costs 50 percent

INGENUITY HELPED American Welding and Manufacturing Company, Warren and Niles, Ohio, produce a jet engine ring at a 50 percent cost savings to the customer.

Problem: The part (a rear compressor outer case) was originally fabricated from a rectangular bar of Type 410 stainless. The bar was formed and flash butt welded.

Amweld engineers wanted to cut down on the amount of relatively expensive stainless being used. They also wanted to reduce the considerable machining needed to cut a flange on the inside diameter.

Solution: A 72 percent savings in stainless was made by changing from bar stock to an extruded section and inserting a forging.

Machining time was reduced because the extruded section closely matched the flange needed on the inside diameter.

How it was done: The extruded section was formed into a 280° ring segment. The forged segment was placed in the opening and flash butted welded at both joints.

The finished ring (inside diameter, 27.840-inches and outside diameter, 30.340 inches) met both government and prime contractor's specifications. ••

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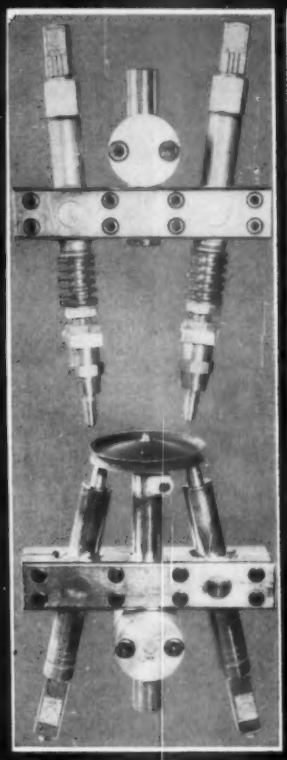

S-M-S

Adjust-A-Angle Adapters with Adjust-A-Pressure Holders solve many welding problems

Change from one electrode spacing to another in a matter of minutes—with the same set-up.

FREE: Write for descriptive data on complete line of resistance welding products.

Another step to better welding.

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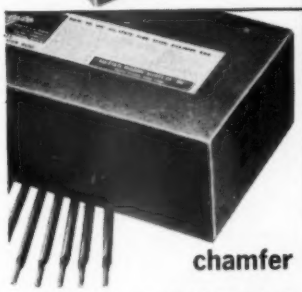
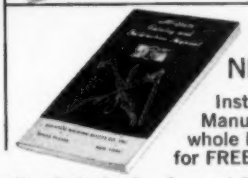
broken · cracked

CAST IRON

can be chamfered · cut · welded in place





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ALL-STATE WELDING ALLOYS CO., INC., White Plains, N.Y.

For More Information Circle No. 5 on Reader Service Card.

NCG Introduces First American-Built Continuous Rail-Welding System

IN BRIEF: Automatic electric rail-welding system produces and installs continuous-welded rail for less cost than bolted-joint rail.

QUARTER-MILE LENGTHS of continuous welded rail emerge from the opening in this special car while standard 39-foot rail lengths are fed into the other end.

A NEW RAIL-WELDING SYSTEM that can produce and install continuous-welded rail for less than the cost of conventional bolted-joint rail has been introduced by Chemetron Corporation.

"Introduction of the first automatic-electric rail-welding system to be manufactured in the U.S. removes the last barrier to large-scale adoption of continuous-welded rail," said Robert A. Baer, head of the rail welding department of Chemetron's National Cylinder Gas Division. "This low-cost development spells doom for bolted rail joints which damage rolling stock and freight and result in high maintenance and replacement costs," he said.

Chemetron obtained exclusive U.S. Manufacturing rights to the patented system from H. A. Schlatter A.G., well-known Swiss producer of resistance welders, a year and a half ago. The first American-built system has been sold to Southern Pacific and another has been under lease to the Great Northern Railway and the Louisville &

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POWER . . . PRECISION . . . PERFORMANCE . . . PRODUCTIVITY

For More Information Circle No. 69 on Reader Service Card.

30-TONS OF PRESSURE push rails toward each other while ends are electrically heated; 50-ton blow makes the weld, squeezing out foreign matter, gases and surplus metal.

WELDING JOB is inspected at joint where two standard-length rails have been joined. Excess metal has been sheared off and joint smoothed by abrasive belt grinding.

Nashville Railroad.

The automated system performs an entire welding operation in about four minutes. The entire operation requires a crew of only seven men. The system can be operated off commercial power lines. For remote locations, it has its own mobile power source.

Rails are fed into the welding unit mounted in its own railroad car. Rail-ends are preheated by electric current to a plastic-molten stage, then welded with a hammer-like upset forging blow of more than 50 tons in an electric flash butt resistance welding operation.

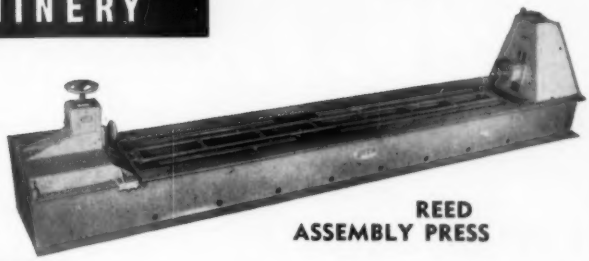
Excess metal is sheared off the joint and the weld moves automatically to the next operation where the joint is smoothed by grinding and is then tested. The system employs belt grinding, instead of abrasive wheels.

WEBB TANK PRODUCTION MACHINERY

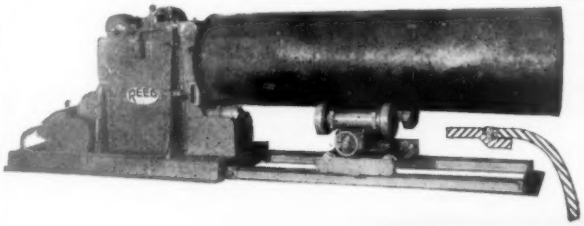
Horn Type Fixtures | Cylinder Flange Offsetters | Assembly Fixtures

REED OFFSETTER

This machine forms an offset flange around shell ends to facilitate automatic welding of tank heads. It eliminates chill rings, decreases fit-up time, improves the concentricity of shell ends, and aids in reducing actual welding time. Tight, clean joints result.



REED ASSEMBLY PRESS



Permits rapid fit-up of tank heads into tank shells where offset joggle joints are used. Hydraulic pressure is applied through ball-and-socket swivel joints that allow the head cups to set to the head. Hydraulically powered kick-outs speed up loading and unloading. Both headstock and tailstock are adjustable vertically.

FOR ILLUSTRATED LITERATURE WRITE DEPT. C.

Unit Type Turning Rolls | Portable Turning Rolls | Automatic Welding Track Supports

REED EQUIPMENT DIVISION
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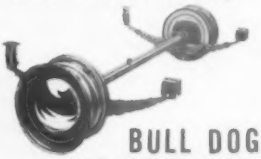
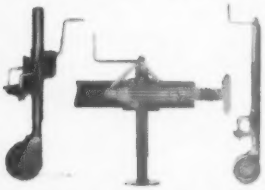


BULL DOG AXLE ASSEMBLIES

BULL DOG JACKS



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Complete Spindle End Assemblies for 2,500, 4,000 and 5,000 lb. capacities Per Pair. Available in complete assemblies or individual parts — Spindle Ends, Hubs, Wheels.

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REFERENCE DATA

catalogs, handbooks, manuals

AIR-GAS TORCHES for every purpose are described in the Ransome catalog available from National Welding Equipment Co. Described and illustrated are burners for various heating, soldering and lead burning applications. **Circle No. 80 on Reader Service Card.**

HIGH-PRESSURE GAS CYLINDERS for oxygen and other industrial and medical gases are featured in a bulletin from Pressed Steel Tank Co. Range of sizes, capacities and ICC specifications are given for weight-saving seamless cold drawn cylinders. **For More Information Circle No. 75 on Reader Service Card.**

RESISTANCE WELDING TECHNIQUES for the overhaul and repair of jet engines and airframes are explained in a comprehensive 32-page engineering report issued by Sciaky Bros., Inc. Illustrated report shows how resistance welding techniques are adapted to meet rigid commercial and military overhaul specifications. **For More Information Circle No. 82 on Reader Service Card.**

A WELDING WIRE COMPARISON CHART released by Page Steel and Wire Division, American Chain & Cable Co., Inc., replaces all previously issued bulletins. Four-page Bulletin DH-1218-O details as-welded physical properties, gives analyses, tensile strength, elongation and average Rockwell hardness numbers. Comparisons between Page products and virtually all competitive makes are presented. **For More Information Circle No. 83 on Reader Service Card.**

SPECIAL PURPOSE ELECTRODES made by Lincoln Electric Co. are the subject of 20-page bulletin 7000.2. The Weldirectory covers manual electrodes for hardsurfacing, and welding stainless steels, non-ferrous metals and cast iron. The booklet describes each electrode, its properties and applications and tells how to use it. **For More Information Circle No. 84 on Reader Service Card.**

TWO HEADS ARE BETTER THAN ONE if they're both on the same electrode holder. Such a holder is described and illustrated in literature from Climax Corp. Design details and advantages are given for the company's twin head holder. Replacement parts and list prices are given. **For More Information Circle No. 85 on Reader Service Card.**

A WET ABRASIVE CUTTING MACHINE is featured in 4-page Bulletin DH-84 just issued by Allison-Campbell Division, American Chain &Cable Co., Inc. Design details and operating instructions are given for Model 481 which will cut solid billets, pipe or structurals and any shape that will fit into an 8-inch circle or square. **For more Information Circle No. 86 on Reader Service Card.**

RESISTANCE WELDERS made by Alphil Spot Welder Mfg. Corp. are featured in a standard specification chart just issued. Complete specifications and data are listed for Alphil projection and spot welders made for all voltages and frequencies. **Circle No. 87 on Service Card.**

HEAD, EYE AND FACE PROTECTION EQUIPMENT are the subject of a condensed catalog page issued by Kedman Company. Described and illustrated is the company's Huntsman line of welding helmets, face shields, lenses and accessories. Sheet is punched for easy insertion in shop notebooks. **For More Information Circle No. 88 on Reader Service Card.**

BEVELLING MACHINES which can speedily cut bevels in ½-inch mild steel or ⅜-inch stainless are described and illustrated in Literature available from American Pullmax Co., Inc. Design details and operating characteristics are given for the machines whose serrated cutters bevel plate, including curved, cylindrical and irregularly shaped parts. **For More Information Circle No. 89 on Reader Service Card.**

FACTS AT YOUR FINGERTIPS: *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

TWO-COLOR ENGINEERING DATA SHEET (No. 7) issued by Wall Colmonoy Corporation explains how the company's Nicrobraz cement is used to apply high temperature brazing alloys. Composition, properties and uses of the new cement are described. Included is a chart showing approximate Zahn viscosity numbers for six different cement thicknesses.
Circle No. 90 on Reader Service Card.

INTEGRATED MULTI-ARC Welding System . . . is the title of a 22-page bulletin available from J. B. Nottingham & Co., Inc. How many arcs from the single power source can be used for submerged arc, stud, consumable electrode and metallic arc welding, and arc air cutting, is explained.
Circle No. 91 on Reader Service Card.

A NEW BENDING BRAKE featured in literature from P. L. Cady has a double apron. According to the manufacturer, these aprons make the unit ideal for use on small or large work, permitting it to compete successfully with press brakes. The hand-operated brake forms any angle bend up to 155° without the use of dies.
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ALUMINUM STUD WELDING is the subject of a 4-page bulletin from Nelson Stud Welding, Division of Gregory Industries, Inc. The bulletin describes how aluminum studs up to ½-inch diameter are welded to aluminum plate under an inert gas shield.
Circle No. 93 on Reader Service Card.

ADJUSTABLE PIPE DOLLIES that provide two-way movement of pipe are the subject of literature from Oxo Welding Equipment Co. Heavy-duty ball bearing design permit pipe rotation as well as longitudinal movement. Capacities, dimensions, weights and prices are given for three sizes: 2- to 16-inch pipe capacity, 16- to 60-inch and 2- inch to 30-inch.
Circle No. 94 on Reader Service Card.

TWO WELDING CABLE ACCESSORIES made by Tweco Products, Inc., are featured in Form JC-100. Described and illustrated are jacket-grippers which prevent jacket slippage and cable connection supports that prevent strand breakage.
Circle No. 95 on Reader Service Card.

SPOOLED ALUMINUM WIRE marketed for inert gas welding by Kaiser Aluminum & Chemical Sales, Inc., is featured in a booklet now available. Full details concerning availabilities, packaging and care of welding wire are included. Filler rod for tungsten arc welding is also described.
Circle No. 96 on Reader Service Card.

19 DIFFERENT ALLOYS AND FLUXES for welding, soldering and brazing copper and copper-bearing alloys are featured in a 12-page folder from All-State Welding Alloys Co., Inc. The folder gives step-by-step instructions for using each of the different alloys and fluxes.
Circle No. 97 on Reader Service Card.

FLUX SAMPLES are available from Krembs & Company which manufactures 25 different welding, brazing and soldering fluxes. Write for yours on company letterhead. Use Reader Service Card for literature.
Circle No. 98 on Reader Service Card.

ALLOY COMPARISON CHART from American Brazing Alloys Company lists the firm's complete line of alloys and compares it to two other leading lines.
Circle No. 99 on Reader Service Card.

continued on page 62

Airline

FEATURES A BROAD VARIETY OF
BACK-UP MANDRELS
FOR AIRLINE LONGITUDINAL WELDING POSITIONERS

MODEL 1064B pre-heated back-up mandrel for use with Airline Model LW 10,000 Series Longitudinal Welding Positioner. Equipped with four "quick-clamp" back-up bar receiving grooves 90° apart. One heating oil inlet and outlet. Each back-up insert receiving groove is equipped with gas back-up plenum.

MODEL 1063B water cooled welding back-up mandrel commonly used for high production submerged arc and MIG welding applications. Equipped with two removable copper back-up inserts.

MODEL 1460A heavy duty welding back-up mandrel designed for welding large cones, cylindrical shaped objects and flat sheet.

MODEL 1060A heavy duty welding back-up mandrel equipped with one copper back-up insert. Designed for welding large diameter and long (up to 12' 0") heavy walled cylindrical objects.

MODEL 1662-4 thermostatically controlled pre-heated mandrel for use in welding medium alloy steels. Equipped with one removable copper insert and gas back-up plenum.

MODEL 1121A small diameter welding back-up mandrel equipped with one removable copper back-up insert and gas back-up plenum. For welding small diameter tubing.

All illustrated mandrels are interchangeable in all Airline Longitudinal Welding Positioners.

Mandrels are available for welding foils of .003" up to sheet stock of .250". Mandrels are furnished for welding ferrous, non-ferrous, austenitic and ferritic metals. Various models are designed to facilitate positioning of tubular, flat or rectangular shapes and are rotatable and interchangeable. Copper, steel or stainless steel back-up bars are furnished with weld "drop-thru" grooves to control weld root bead, size and contour. Many models are furnished for inert gas backing, featuring a plenum gas reservoir. Inserts are provided with orifices for uniform gas distribution along the weld. Many of these models are designed for normal "chill-shunt" weld tooling principles while others employ thermostatically controlled heating or water cooling.

Stainless steel and steel back-up inserts are for use in welding non-ferrous materials such as aluminum and magnesium alloys. Copper back-up inserts are used for welding steel, stainless steel, titanium, tantalum, molybdenum, zirconium, beryllium-copper, etc.

Write for complete information on Airline Longitudinal Welding Positioners and accessory equipment.

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760 NORTH PRAIRIE AVENUE, HAWTHORNE, CALIFORNIA
OSBORNE 5-2225 OSBORNE 5-3156 OREGON 8-5112

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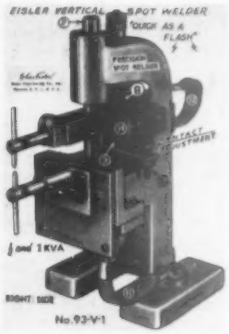
EISLER *makes*

the largest selection of spot, wire butt and foil welders . . .



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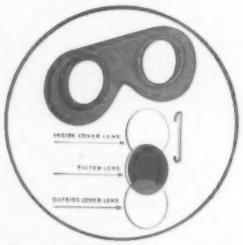
President

Model #492



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For More Information Circle No. 76 on Reader Service Card.

USEFUL LITERATURE *continued*

ROTARY BENDING BENEFITS that can be obtained with big or little rotary benders made by Wallace Supplies Mfg. Co. are explained in a comprehensive brochure. A complete line of machines is described and illustrated and specifications listed. Case histories are shown.
Circle No. 100 on Reader Service Card.

LIQUID-PROOF CLOTHING is the subject of Catalog No. 28 available from Olympic Glove Co., Inc. The literature explains and illustrates special and standard clothing items for complete head-to-toe protection against rocket fuels, as well as acids, alkalis, oils and chemicals, both in liquid and powder form.
Circle No. 101 on Reader Service Card.

A UNIVERSAL CUTTING MACHINE with a special hardened cutting blade is the subject of literature from Metal Removal Co. Design details and operating characteristics are given for the Trennjager Model UNI-8A which can be used on angle irons up to 4-by 4-inches, pipes up to 4½-inches and solid bars up to 1¼-inches.
Circle No. 102 on Reader Service Card.

DYE PENETRANT INSPECTION is the subject of a 4-page report from Turco Products, Inc. The brochure gives a brief and thorough explanation on how to use the dye penetration process to detect flaws.
Circle No. 103 on Reader Service Card.

POWDERED METALLURGY and how it is used to make resistance welding electrodes and circuit-breaking contacts is explained in a data sheet from Dobbins Mfg. Co. The sheet gives complete specifications and sizes for 8 different grades of alloys.
Circle No. 105 on Reader Service Card.

ULTRASONIC CLEANING EQUIPMENT is described and illustrated in literature from Acoustica Associates, Inc. Complete information and specifications are given on various size generators and transducers.
Circle No. 107 on Reader Service Card.

CRACK DETECTION MACHINES are the subject of an illustrated brochure from Peterson Machine Tool, Inc. The brochure describes the company's complete line of magnetic particle inspection equipment and accessories.
Circle No. 108 on Reader Service Card.

AN 11" BY 17" WALL CHART listing all AISI grades of cold finished steel bars is available from LaSalle Steel Company. The chart lists 241 grades of steel bars. It covers screw machine steel, resulphurized carbon steel, open hearth and alloy steels. Also included in a table of weights in pounds per foot.
Circle No. 110 on Reader Service Card.

INDUSTRIAL ELECTRONICS is the subject of illustrated 6-page folder from Gulton Industries, Inc. The folder describes and illustrates various types of equipment, including ultrasonic welders and soldering irons, for industrial and military applications.
Circle No. 111 on Reader Service Card.

HIGH FREQUENCY INDUCTION heating units for brazing, annealing hardening, soldering and bombarding are described in literature from Lepel High Frequency Laboratories, Inc. The brochure gives complete specifications and design details on Models T-51-N and T-5-3N 5 KW electronic tube generators.
Circle No. 112 on Reader Service Card.

"CREATIVE CRAFTSMANSHIP in steel" describes coordinated engineering, fabrication and erection services offered by Chicago Bridge & Iron Co. The 4-page booklet also illustrates and describes CB&I-built storage and pressure vessels, Hortonclad and special alloy structures.
Circle No. 113 on Reader Service Card.

ULTRASONIC GAGING is explained in an 8-page folder issued by Branson Instruments, Inc. The folder explains what the process is, what it does and how it works. Equipment and accessories used for detection of laminar flaws and thickness measurement are described.
Circle No. 114 on Reader Service Card.

COMBINATION HARDNESS TESTER, which tests both Rockwell and Rockwell Superficial hardness, is described in a data sheet prepared by the Wilson Mechanical Instrument Div., American Chain & Cable Co. Operating features, standard equipment, optional accessories and prices are given for Model TT TwinTester.
Circle No. 115 on Reader Service Card.

A PRESSURE-FIRED WELDER, is described in a brochure from Weldmatic Division of Unitek Corporation. Complete specifications are given for the company's handpiece which furnishes 25 lbs. of electrode pressure, and accommodates up to 500 watt- seconds of energy—without water cooling.
Circle No. 116 on Reader Service Card.

WELDING OPERATOR PROTECTION with vinyl-coated glass fabrics is explained in a brochure from Fyrepel Products, Inc. Described is a three-piece garment that weighs only 19 ounces and gives shoulder protection, arm coverage and apron-frontal protection.
Circle No. 117 on Reader Service Card.

CLAMPS FOR ANY APPLICATION are to be found in 32-page Catalog No. 19 issued by Adjustable Clamp Co. Design details and specifications are given for handscrews, bar clamps, clamp fixtures, "C" clamps, hinged clamps, press screws and other types of clamps.
Circle No. 2 on Reader Service Card.

258-PAGE STEEL AND ALUMINUM DATA BOOK issued by Joseph T. Ryerson & Son, Inc., includes aluminum analyses, characteristics, mechanical properties and tolerances of aluminum, along with machining and fabricating data, tolerances, weights, ASTM standards and compositions and properties of steel. Pocket-size book can be obtained from any Ryerson plant or by writing to Box 8000-A, Chicago 80, Illinois.
Circle No. 119 on Reader Service Card.

NEW HYDRAULIC PRESS BRAKES with stroke adjustment are featured in a colorful catalog from O'Neil-Irwin Mfg. Co. Specifications and capacities are given for the company's Di-Acro Hydra Power press brake. Also featured is a hand-operated press brake with 8 tons of power.
Circle No. 104 on Reader Service Card.

THE SEEING EYE BOROSCOPE is discussed in a pamphlet available from the Lennox Instrument Company. The instrument permits close visual internal inspection on applications such as gun barrels, tubing, cylinders, etc.
Circle No. 109 on Reader Service Card.

DETERMINING THE PROPER specifications to apply to the various types of carbon, alloy and stainless steel tubing, pipe, seamless welding fitting and flanges is explained in a new 4-page folder published by Tubular Products division of Babcock & Wilcox Co. Folder TDC-186 is a ready cross-reference between the type of steel, the application and the specifications covering the product.
Circle No. 106 on Reader Service Card.

10 DAY FREE TRIAL

GRAND
Manufacturers Since 1921

SHOP CADDY

The Answer To A Thousand Lifting Jobs in Every Shop! Saves Space, Labor, Time!

Helps you cut handling and storage costs in many ways! True versatile lifting performance. No I-beam installation even in cramped or narrow quarters. Comfortable handle for easy trucking. 4 speed hydraulic ram lifts 500 lbs. in ½ minute. Raise load from floor 36". Variable speed adjustment. Rugged tapered nose plate slides easily under heavy boxes. Steel 20" x 16" pallet for heaviest constant use. Heavy duty mold on rubber roller bearing (8") wheels. Convenient foot rests make load easy to balance. Sturdy balance fork prevents tipping.

No. 4036—Wgt. 107 lbs. $148.80
No. 4054—Pallet 22"W x 19" L 54" lift. Wgt. 122 lbs. $179.80

Write For 10 Day Free Trial On Your Letterhead

Allied Mfg. & Sales Co.
3103 W. GRAND AVE.
CHICAGO 22, ILL.

Circle No. 33 on Reader Service Card.

PROTECT your acetylene cylinder investment!
Get all the facts about the

ALL NEW COYNE 92

(92% POROSITY FILLER)

ACETYLENE CYLINDER

ALL NEW FILLER
Highest porosity — greatest gas capacity

STRONGER STEEL SHELL
Most durable in the industry

FIELD TESTED FOR YEARS
Guaranteed under all conditions

PICK UP YOUR PHONE
NOW and call (COLLECT)
to the nearest office of the
COYNE cylinder company

SAN FRANCISCO:	PLaza 6-6910
MEMPHIS:	WHitehall 8-7739
CHICAGO:	GLenview 4-3828
NEWARK:	Mitchell 2-1618

or write

224 Ryan Way, So. San Francisco, Calif.
155 W. Bodley Ave., Memphis, Tenn.
3800 Springdale Ave., Glenview, Ill.
24 Commerce St., Newark, N.J.

Circle No. 21 on Reader Service Card.

WELDING MANAGEMENT

• *watches these developments*

HEAVY END ALUMINUM PIPE just introduced by Reynolds Metals Co. is said to offer increased strength and thickness at pipe ends where welded or threaded joints are made while actually using less metal in the pipe body. The company estimates this offers users operating pressures equivalent to standard pipe with cost savings ranging by pipe size up to 27 percent. Made by a new extruding process, heavy end pipe is presently available in selected sizes equivalent to many standard Schedule 40 and 80 sizes.

PACKING WELDING ELECTRODES IN WOODEN BOXES is still the practice at Rankin Manufacturing Co., Alhambra, Calif. Why?

There are two big reasons according to Rankin's sales manager, P. H. Welty. They are: Better electrode protection and advertising value.

The company feels wooden boxes (held by W. D. Rankin, left) do a better job of protecting electrodes. It steel-straps boxes with strap loads that would crush conventional fiber-boxes. And, for moderate-distance overseas shipping to places like Hawaii, wooden boxes need no added protective packing. They keep out moisture so well that electrodes need little or no conditioning before use, even in humid climates. For example, Welty tells that a box of electrodes lost for nine years in the hold of a Mississippi River boat were in serviceable condition when found.

Welty explains that wooden containers with Rankin's name and trademark have tremendous advertising (association) value. He says this association value more than pays for the higher cost (pine boxes are four times heavier, cost twice as much and, since they come to the Rankin plant assembled, take up more storage space before being filled than knocked-down corrugated boxes.) Welding personnel use the boxes for tool and parts boxes on the job—and at home. The Rankin name is always in front of them.

A GIANT DRY HYDROGEN FURNACE for vertically brazing assemblies as big as 10-feet long or six-feet in diameter can produce brazed assemblies to meet rigid, distortion-free specifications of atomic energy and missile programs. The furnace developer, Stainless Process Division, Wall Colmonoy Corp., says vertical brazing is vital in these fields because it thoroughly circulates furnace atmosphere to every brazed joint, turning out parts with greater dimensional accuracy than possible with horizontal methods formerly used. Furnace can be used for controlled atmosphere brazing, heat treating or annealing with pure dry hydrogen, argon, carbon dioxide, nitrogen or exothermic gases.

A SERIES OF SUPER INSULATIONS up to 26 times more efficient than standard vacuum insulations and capable of holding liquid oxygen for indefinite periods is now in use by Linde Company, Division of Union Carbide Corp. The insulations permit Linde to build liquid oxygen storage tanks for missile stands that will hold the volatile liquid for months and even years with little loss. Liquid hydrogen and liquid helium storage containers that need no liquid nitrogen coolant can also be built.

A SHORTAGE OF HELIUM is indicated by a form letter mailed to suppliers of the U. S. Army's Columbus, Ohio, General Depot. The letter says: "This agency has been requested to obtain the cooperation of its contractors in the conservation of helium. It is requested that you review your shielded arc welding operations and, unless specifically required by your contract, utilize a substitute for helium, such as argon."

A SLIGHT INCREASE in business was reported in the third quarter of 1958 by 150 members of the National Welding Supply Association. Sales in that period averaged one percent better than in the same period in 1958. The biggest gain was 10 percent in the Western Zone: Arizona, Utah, Nevada, California, Oregon, Washington, Idaho, Hawaii.

Sales for the first nine months of 1959 compared to the same period in 1958 were down an average of two percent according to the same 150 distributors. Leading was the West Central Zone (Missouri, Iowa, Minnesota, North Dakota, South Dakota, Nebraska, Kansas, Colorado, Wyoming and Montana) with an increase of 15 percent.

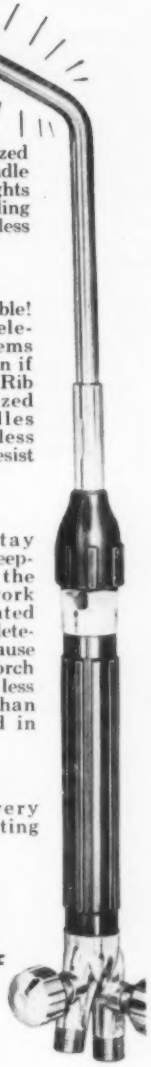
A PLANNED SCIENCE INDUSTRY CENTER has been established to meet the needs of science-oriented industries seeking suitable accommodations at the nation's capital. Designed for such industries, and to meet the growing demand for efficient plant sites as well as prestige location, Washington-Rockville Industrial Park is situated in Montgomery County, Maryland, only a few minutes away from key government agencies. The Center is designed for efficient research and production in a parkland-campus atmosphere. Write for illustrated literature from Washington-Rockville Industrial Park, Rockville Pike at Randolph Road, Rockville, Maryland.

BUSINESS WILL BE BETTER in the first quarter of 1959 (compared to the same period in 1958) according to 72 percent of the 1,548 business men participating in a Dun & Bradstreet survey. Only four percent expected declines. Other opinions for the same two periods: In 1959 a less cheerful profit outlook, a rise in inventory and steady prices.

FINISHED STEEL PRODUCTS SHIPPED during October, 1958, totaled 6,224,540 net tons—nearly 16 percent more than in September—the highest since October, 1957, according to the American Iron and Steel Institute. During the first 10 months of the year, shipments totaled 49,226,073 net tons against 69,155,531 net tons during the same months of 1957.

AGAIN HIGHLIGHTING THE ANNUAL N.W.S.A. CONVENTION is the Association's contact booth program which gives distributor and manufacturer members a chance to meet and discuss mutual problems. This year's contact booth program will be held on Tuesday afternoon, May 5th, in the Gold and Nob Hill Rooms of the Hotel Fairmont, San Francisco. The National Welding Supply Association Convention runs from Monday, May 4, through Wednesday, May 6. The Association's Convention Committee headed by Norman H. Balaam is completing arrangements which will be announced in full in the April issue of INDUSTRY & WELDING.

WHY
THIS TORCH SPEEDS WELDING
3 ways!



1 LIGHTER . . .
high strength anodized aluminum alloy handle reduces torch weights by one-third. Welding is done faster, with less operator fatigue.

2 STRONGER . . .
and more dependable! Spring loaded, telescoping valve stems are protected even if torch is dropped. Rib reinforced, anodized aluminum handles with tough stainless steel torch heads resist wear-damage.

3 COOLER . . .
torch handles stay comfortably cool, keeping operators on the job with fewer work breaks. Over-heated handles are completely eliminated because the stainless steel torch head is seven times less heat conductive than brass heads used in other torches.

4 MODELS
A model for every welding and cutting need.

- *Super-Jet*
- *Aero-Jet*
- *Star-Jet*
- *Jet-O-Matic*

WRITE NOW for illustrated catalog.

MARQUETTE
MANUFACTURING COMPANY, INC.
307 E. Hennepin Ave.
MINNEAPOLIS 14, MINNESOTA

Circle No. 47 on Reader Service Card.

NEW PRODUCTS

Automatic Arcair Torch

The model Q-3 automatic torch introduced by Arcair Company fills the need for automatic joint preparation. The unit consists of a head with an electrode feed mechanism which feeds consumable copper-coated carbon-graphite electrodes as required and supplies a jet of air at the proper location.

The head is mounted on a tractor permitting straight line or circular travel at pre-determined speed. The head can be removed from the tractor and mounted on positioning equipment in the same manner as an automatic welding head.

The head can be set at any angle with the work to produce a variety of grooves and bevel contours. It will handle electrodes ranging from $\frac{3}{16}$- to $\frac{3}{8}$-inch diameter. Tractor has a speed of zero to 180 ipm.

Circle No. 120 on Reader Service Card.

Brazing Cement

A liquid plastic material has been developed by the Stainless Processing Div., Wall Colmonoy Corp. for applying powdered brazing alloys.

Nicrobraz Cement acts as both a vehicle and a binder; it can be mixed with any powdered alloy and applied to the joint; and it will hold the alloy in place during application and handling, and placement in the furnace. It disappears at about 550°F, leaving no residue. Comes in 6 viscosities, one for each joint condition.

Circle No. 121 on Reader Service Card.

New Grinding Discs

A new type of aluminum oxide grinding disc designed to provide up to 25 percent greater operating safety is now offered by Abrasive Products, Inc. Called "Spitfires," the new solvent- and water-proof discs feature fully reinforced edges and a special built-in shape control which eliminates limpness and disintegration due to excessive grit loss.

Spitfire discs are available in special, standard and heavy duty models in grit sizes 16 through 180. Diameters include 6-, 7-, 8- and 9$\frac{1}{8}$-inches with $\frac{1}{2}$- and $\frac{7}{8}$-inch arbor holes.

Circle No. 122 on Reader Service Card.

Balanced Wave AC Welder

Virtual elimination of the DC element in power supplied by Miller Electric's new balanced wave AC welder reportedly returns distinctly superior results in hand or automatic fixture tungsten inert gas arc welding.

Positive control of high open circuit of 165v and arc stability are guaranteed by the manufacturer. Absence of capacitors removes annoyance of arc-outs. Automatic "fail safe" voltage reducer for hand welding and remote amperage control receptacle are standard equipment.

The Miller B-W model welding current ampere ranges are 10-165, 20-260 and 135 to maximum. Rated welding current, 60 percent duty cycle at 40v, is 300 amps.

Circle No. 123 on Reader Service Card.

4000-Watt Spot-Type Ultrasonic Welder

The largest spot-type ultrasonic welder currently being marketed by Aeroprojects Incorporated is a 4000-watt unit which is used for joining medium-heavy gages of materials such as aluminum and copper. It can also be used on somewhat thinner gage sheets of metals and alloys such as titanium, zirconium, molybdenum, Inconel and others. Spot-type welders such as this one are also manufactured in sizes ranging down to small 100-watt instrument welders for joining fine wires and thin foil materials.

For More Information Circle No. 124 on Reader Service Card.

Radiation Protection

LeadX is a vinyl-lead material used in radiation protective aprons made by Bar-Ray Products, Inc., for industrial and medical use. Lighter in weight than conventional lead-rubber aprons of same lead equivalent, material offers thorough protection in any lead equivalent. Standard unit has .5 mm lead equivalent.

Thoroughly tested under massive radiation from 100,000/r to 1,000,000/r with no physical change, material is unconditionally guaranteed against manufacturing defects, cracking or deterioration for one year.

Material is also available in sheeting for special applications.

Circle No. 125 on Reader Service Card.

more new products on page 68

MESSAGE #4 *This message is for men who are vitally concerned with such welding problems as maintaining a smooth flow of production... preventing excessive rejects... and insuring trouble-free, economical, profitable operation*

Welding Wire: Cost-saving and Profit Factors

Production men who are conscious of *both cost and quality* agree that a top-grade weld demands the *right* welding wire. *Only* by using wire with an analysis suited to the material to be welded can consistently sound welds—free from porosity and internal cracks—be produced. Use of the right wire means fewer rejects, less waste, lower costs—plus a better finished part or product.

Experienced welding men have long found PAGE a most reliable source of welding wire for all their regular and special needs. The wide range of PAGE analyses—33 of them—makes it possible to select the exact wire that produces the kind of welds that lower production costs and increase profits.

PAGE experience, talents and facilities are available to you at all times. We have been exclusive wiremaking specialists for more than half a century, and are in an ideal position to furnish our customers with the right wire for each specific need. Furthermore, we have developed a broad packaging program which saves time and money by supplying wire packaged to meet any requirement.

These factors, plus PAGE'S nationwide set-up of conveniently-located distributors, backed up by PAGE warehouse stocks, help make it profitable for you to standardize on PAGE Welding Wire.

PAGE offers—
33 ANALYSES
...the right analysis for your welding job

There are *33 different analyses* in the PAGE line, covering the broadest range of applications: submerged arc...inert gas...tungsten or metal arc...oxy-acetylene gas welding...metal spraying.

For example—

ANALYSIS A-S-6...This mild steel wire is used for welding mild steel where exceptional ductility is required. Its high elongation is obtained by holding the carbon (.06), manganese (.15) and silicon (.03) to the very low maximum given in parentheses. Analysis A-S-6 is very close in physical properties to AS-Armco. Used either with inert gas or a neutral flux, it will give clean non-porous welds averaging 50,000 p.s.i. tensile and 35% elongation with a Rockwell Hardness of B-65. Analysis A-S-6 is also used for PAGE C Gas Welding Rods for oxy-acetylene welding, where it is the most generally used of all gas welding rods. PAGE C gas welding rods, used with a neutral flame, will give the same physicals as A-S-6.

For example—

ANALYSIS A-S-17...Analysis A-S-17 is a modification of the most popular submerged arc welding wire—PAGE A-S-10, which contains only a trace of silicon. In A-S-17, silicon is deliberately added up to .20% for use with inert gas. The added silicon is a strong deoxidizer, scavenging the molten metal and giving a strong weld free from porosity, together with cutting down spatter and, through a more stable arc, giving deeper penetration. All of this leads to higher physicals: up to 65,000 p.s.i. tensile and 30% elongation. It is recommended for CO_2 inert gas welding of low carbon steels, rather than A-S-10.

NOTE: previous advertisements in this publication have included brief descriptions of PAGE Analyses A-S-8620, A-S-6150, A-S-30, A-S-NAX-9115, A-S-65 and A-S-Armco Iron.

Write for—Welding Wire **Comparison Chart DH-1218** (shown above). This highly informative, four-page chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Also shows uses and physical properties, including: tensile strength, elongation, Rockwell hardness. Chart lists virtually all competitive makes.

Write for—Submerged arc and inert gas welding wire **Folder DH-402A**...also gas welding rod **Booklet DH-1277.**

• • •

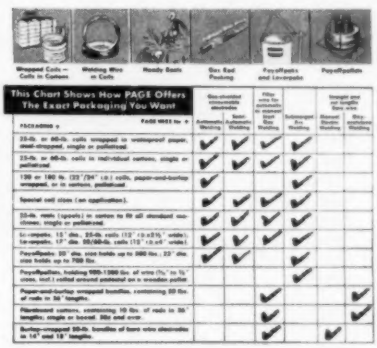
PAGE offers—
Packaging to meet your needs

PAGE Welding Wires are packaged in a wide variety of ways—for the most complete protection and the utmost convenience in handling, in stocking and in use. Here are some major types of PAGE packaging:

1. **Paper-wrapped Coils**
2. **Coils in Cartons, Palletized**
3. **Bare Coils (packed in Leverpaks)**
4. **Masonite Reels**
5. **Payoffpaks**
6. **Payoffpallets**
7. **Gas Rods in Burlap-wrapped Bundles**
8. **Stainless Gas Rods in 10-lb. Tubes**

For example—

PAYOFFPAKS...Up to 700 lbs. of wire, without a single weld...coiled around a fiberboard cylinder within a fiberboard drum...ready to be smoothly unreeled to the welding head for automatic or semi-automatic welding! Eliminates costly machine down-time for coil replacement. Payoffpaks come in three sizes: 20" diameter (holds 250 or 500 lbs.); 23" diameter (holds up to 700 lbs.).



Write for—**PAGE Welding Wire Packaging Chart.** • This useful chart shows the many kinds of packaging of PAGE Welding Wires for each type of welding.

• • •

PAGE offers—
Availability from local stocks

Here is a handy service that not only gets you the welding wire you need when you need it, but saves you money by making it unnecessary for you to tie up a sizeable investment in wire inventory.

You can get the exact PAGE automatic welding wire and welding rods your job requires direct from your nearby PAGE Distributor. Located at many points from coast to coast, PAGE distributors carry sizeable stocks for your convenience—and they are backed up by PAGE Warehouses at the strategic locations shown below. Close cooperation between PAGE distributors, PAGE warehouses and the PAGE mill is your guarantee of prompt, intelligent, individual service on your specific needs.

ACCO

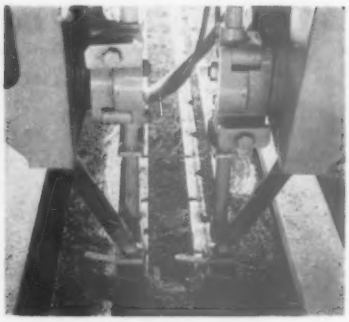
Page Steel and Wire Division
AMERICAN CHAIN & CABLE

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*
Los Angeles*, New York, Philadelphia*, Portland, Ore.
San Francisco*, Bridgeport, Conn.
**Indicates PAGE warehouse stocks*

ACCO for Better Values

For More Information Circle No. 52 on Reader Service Card.

NEW PRODUCTS *continued*



Dual-Head Automatic Speeds Track Rebuilding

A fully-automatic track link welding machine equipped with dual welding heads is now available from L and B Welding Equipment Inc.

Designed for service shops maintaining crawler-mounted equipment, the machine reduces track rebuilding time and cost. In 14 hours an operator can buildup both sides of a complete set of D8 tracks worn ¼" deep.

The new unit includes a patented electric template which permits setup in minutes.

Circle No. 164 on Reader Service Card.

Welding Gun Makes Thermocouple Junctions

Research Incorporated announces a new portable welding gun used for welding thermocouple wire. The unit contains a two channel weld sequence circuit and a pneumatic system for controlling the weld and forge pressure applied by the gun.

The type, kind and diameter of wire determine what technique is used; two separate instrument settings of weld time, weld heat, weld pressure and forge pressure are required for each complete junction. A switch on the welding gun enables the operator to switch from one preset channel to the other.

Circle No. 165 on Reader Service Card.

Torch Kit

Two new kits for heating, brazing or soldering jobs have been announced by the Universal Cutting & Welding Eqpt. Mfg. Co. The big 5 kit includes: #8 soldering iron, 5 torch stems (heavy through fine), torch handle with needle valve control, regulator, hose, and carrying case. The Standard 5 kit is for use where precise control is unnecessary. It does not have a needle control valve nor the regulator. Tank unions are included.

Circle No. 166 on Reader Service Card.

New Solder

A new soldering development of the Permalatem Welding Alloys, Inc. is their Perma-loy 2000. It fills the gap between the non-matching high melting silver solders and low melting soft solders. It matches stainless steel, won't darken, and is at least 10 times stronger than soft solders.

The alloy can be put on with an iron without forming unbonded islands. It has good capillary action and flows free; bonds at 378°F, remelts at 480°F. Works well on brass, copper, steel, etc. Companion flux residue washes off easily with water.

Circle No. 167 on Reader Service Card.

Miniature Head For Resistance Welding

The Weldmatic Division of Unitek Corporation offers a new head for resistance welding. Only 4½ inches of bench space is required for this lightweight unit. It can be used for ultra-fine welding of gold-gallium wire to cover, platinum filaments to tinned brass posts, aluminum foil to itself and other material combinations.

This new head may be plugged into any Weldmatic Power Supply, or it may be used with AC equipment at reduced settings. The head is operated by a foot pedal. Electrode pressure is continuously adjustable from 4 oz. to 15 lbs.

Circle No. 168 on Reader Service Card.

Contour Big Pipe

. . . with the Model 424 Mechanical Draftsman manufactured by Steffan Manufacturing Corp. The Pipe can be as big as 24 inches across and the cut-angle changed during progress with the aid of a variable beveling attachment; a perfect fit-up contour results.

Circle No. 169 on Reader Service Card.

Sprayed Tungsten Carbide

A new spray-powder material developed by Metallizing Engineering Co., Inc., for use with the company's Metco Thermospray gun is said to permit hard facing with sprayed tungsten carbide at very high deposit efficiency: better than 90 percent and extremely high concentration of the carbide. Any required coating thickness may be applied. Coatings are torch-fused after spraying and the close control of coating thickness permitted, plus comparatively smooth surface produced, minimize finishing operations.

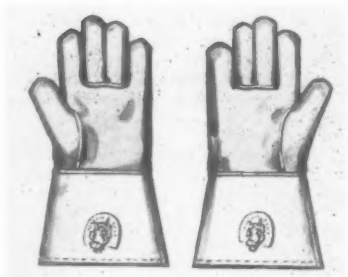
Circle No. 130 on Reader Service Card.

Flux for Aluminum

The Lake Chemical Company has announced a new product, La-Co Aluminum Flux, for use with any solder on aluminum and its alloys.

Temperatures and techniques used are ordinary; elbow grease is out; there's no sanding, scraping, or pretinning necessary. Reason: An intense metal preparing cleaning action.

Circle No. 131 on Reader Service Card.

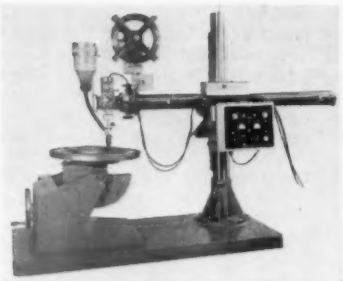


Reversible Welding Glove

A reversible glove whose front and back are identical in pattern —there are no exposed seams on either side—has been introduced by Singer Glove Mfg. Co. The patented glove fits either hand with equal comfort and feel. It is made of heat-resistant horsehide and is green and brown in color.

Aptly named "Singer Solo," the glove comes packed singly, which means it can be ordered three at a time instead of in pairs.

Circle No. 132 on Reader Service Card.



Automatic Welding Fixture

A new, flexible manipulator for automatic welding has been announced by Miami Specialties Co.

The boom has infinite travel speeds from 10 to 150 inches per minute and is powered by a ¼ hp, 110 volt DC motor. Maximum clearance of the boom is 42-inches and the effective weld length is 42-inches.

The vertical lift speed is 12 ipm through a double-worm gear reduction box powered by a ¼ hp, 110 volt DC motor. The mast pivots 360°. A limit switch prevents over travel on the down position.

The pedestal base measures 36 inches wide, 72 inches long and 4¼ inches high.

A control panel (optional equipment) can be mounted on the manipulator or remotely mounted. All motors and cables have plug-in features.

Circle No. 126 on Reader Service Card.

Magnesium Solder

A new product of the Eutectic Welding Alloys Corp. is Eutecrod 1909, a low melting, self-fluxing solder-type alloy for building up, sealing and filling magnesium castings, wrought forms and extruded shapes. It is lead-free, but begins to melt at 350°F., well below the transformation temperature of heat-treated magnesium alloys. With the correct flux, the alloy can also join aluminum to itself, and to other metals.

Circle No. 127 on Reader Service Card.

Electronic Welding Control

A new synchronous electronic control designed for use with small bench welders has been announced by Robotron Corp. According to the manufacturer, the new Model 10E49E-A controls the weld current of all types of resistance bench welders and is especially suited for use on small, delicate parts.

The control is available for 115/230 voltage range and is equipped with two plug-in thyratron firing tubes. The thyratron contactor is rated at 12 amperes at 50 percent duty cycle and with a five-second averaging time.

External cabinet dimension are 22-inches wide, 15-inches high and 10-inches deep.

Circle No. 128 on Reader Service Card.

Soldering and Brazing Unit

A new quick-heating device known as Thermo-Weld has been introduced by Auto-Test, Inc. for soldering and brazing applications. Unit consists of a portable power cabinet, line cord, foot switch, grounding clamp and cable and high-current carbon electrode. Thermo-Weld draws current only when foot pedal is pressed.

Circle No. 129 on Reader Service Card.

more new products on page 70

TISCO®
TIMANG®
Manganese-Nickel Steel
WELDING PRODUCTS
Timang Manganese Welding Rod fuses easily and does not weaken the parent metal. Weld has the same work hardenability and wear characteristics as Manganese Steel. Rods, Bars, Plates, Etc. are excellent for repairs and new installations.
WELDING ROD — PLATES — BARS — SPECIAL SHAPES
TAYLOR-WHARTON CO.
DIVISION OF HARSCO CORPORATION
HIGH BRIDGE 10, NEW JERSEY
PLANTS: Cincinnati, O. — Birmingham, Ala. — Easton, Pa.
SALES OFFICES: New York — Chicago — San Francisco

For More Information Circle No. 62 on Reader Service Card.

NEW PRODUCTS *continued*

Frozen Pipe Thawer

Porta-Thaw is a small, portable transformer developed by Hobart Bros. Co. to thaw frozen pipes by using ordinary domestic AC electric currents: 110 or 220 volts, single phases, 50 or 60 cycles. It is complete with a 10-foot power cable with plug and receptacle and two 20-foot thawing cables with lugs and pipe clamps. The transformer is rated at 300 amps, 10 volts on 100 percent duty cycle. Four output terminals of long-life bus-type provide for three thawing steps: high, medium and low.
Circle No. 133 on Reader Service Card.

Mechanically-Held Control Relay

A new line of mechanically held control relays, rated at 10 amperes, 600 volts, has been introduced by Square D Company. The Type D relays mount in the same panel space as standard electrically held relays. This eliminates the need for mounting mechanically held relays separately. With this new design, both mechanically and electrically held relays can be mounted on the control panel in the proper sequence as they appear on the elementary diagram.

The new relays are offered as completely factory-assembled units, or as electrically held relays and mechanically held attachments for customer assembly. A stock of electrically held relays, plus a few mechanically held attachments, reduces inventory requirements and provides maximum flexibility.
Circle No. 134 on Reader Service Card.

Burdett's New Package

A distinctive new type of packaging for brass fittings and connections is now being used by the Burdett Oxygen Company. The company's "Gateway" cylinder and hose connections are now being packaged in attractive, durable green and black boxes clearly marked for rapid selection. Boxes are pre-packaged in corrugated master boxes for extra protection.
Circle No. 135 on Reader Service Card.

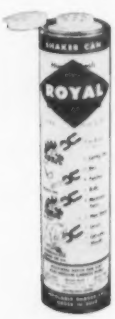
Universal Power Unit

The universal power unit and positioner marketed by Be-Co Engineering Co. operates on 115 volt AC current in the shop or on DC current supplied in the field by a portable welder; it turns any round, nearly round, or hexagonal object for welding or cutting.

The unit weighs only 71 pounds. It operates at a maximum of 450 pounds circumferential turning force and at a surface speed of from 3 to 30 ipm.
Circle No. 136 on Reader Service Card.

IT'S NEW: SO HANDY Economical Too NEW "ROYAL" HARDENING POWDER

In the Shaker Can



"ROYAL" HARDENING POWDER is safe to use. No Toxic fumes. Hardens low-carbon steels equally as well as cyanides.

- So easy to use now. Just sprinkle "ROYAL" on heated edge of Tool, Plow Share or other articles to be hardened. Let "ROYAL" liquidize in heat.
- Remove, clean and quench in regular manner.
- Enables the weldor or blacksmith to produce a finer cutting tool with longer life, without expensive equipment.
- Produces a .01 to .02 in. case depth with necessary Brinnell toughness on large or small low-carbon steel tools or parts.

Send for free sample and literature.

Manufactured Only By
ANTI-BORAX COMPOUND CO., INC.
FORT WAYNE, INDIANA

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Industry's Fastest Selling CYLINDER TRUCKS

Many Styles For all Sizes of Cylinders

Write for full Information

LT-200 KC-50

ASK THESE DEALERS

CLIFFORD F. SCHULTZ & CO.
4637 N. Knox Avenue
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BURNIDGE OXYGEN DISTRIBUTING CO.
301 East 18th Avenue
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MIDWEST OXYGEN EQUIPMENT CORP.
1664 W. Ogden Avenue
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BUDD WELDING SUPPLY COMPANY
P. O. Box 387
Minot, North Dakota

Welded Truck & Specialty Co.
1306 DIVERSEY PKWY • CHICAGO 14, ILLINOIS
SOLD ONLY THRU "INDEPENDENT DEALERS

Circle No. 73 on Reader Service Card.

ACORN

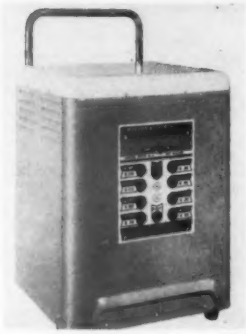
BENDING BLOCKS or WELDING PLATENS

Semi-steel Blocks for layout, welding assembly work, etc., with machined working surfaces; also tools and accessories, including a full line of clamps, drift pins and dogging devices. Standard and special stands can be supplied. A 4-unit set-up, joined and mounted on stands, is shown above.

WRITE TODAY FOR LITERATURE

ACORN
IRON & SUPPLY CO.
Delaware Avenue at Poplar Street
Philadelphia 23, Pennsylvania

Circle No. 1 on Reader Service Card.

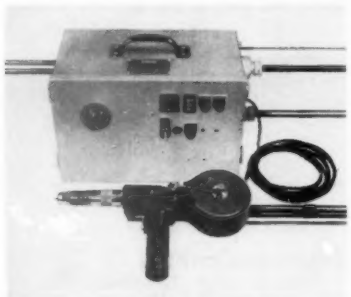


AC Arc Welders

A line of AC arc welders in the 90, 180 and 295 amp sizes for use on farms, in schools, maintenance and hobby shops has been introduced by Emerson Electric Mfg. Co. Outstanding features on the more popular 180 amp welders are: wheels for easy portability; NEMA rating; UL CSA and REA approval; fan cooling, on-off switch; 80 open circuit voltage to permit use of low hydrogen and stainless electrodes and availability with or without accessories.

Also available is a 200 amp DC gas engine-driven portable welder with AC auxiliary power take-off outlets.

Circle No. 137 on Reader Service Card.



New Welding Torch

For consumable-electrode inert-gas metal-arc welding, Linde's new Sigmette torch combines portability and easy maintenance. The wire spool mounted on the torch lets the operator get at jobs in confined spaces and areas remote from power and gas supply.

The Sigmette torch weighs 3-pounds, the control box weighs less than 20. Rated at 200 amps, the torch will handle the full welding range with $\frac{3}{64}$-inch aluminum wire; applications on aluminum .093- to ⅛-inch thick using .030-inch wire up to 125 amps; limited applications with $\frac{1}{16}$-inch aluminum wire; and .030-inch carbon steel wire. Torches are available for the full welding range with either .030- or $\frac{1}{16}$-inch aluminum wire.

Circle No. 138 on Reader Service Card.

more new products on page 72

For More Information Circle No. 29 on Reader Service Card.

Flood FIBER GLASS WELDING HELMETS

For Safety, Comfort and Economy

These seamless fiber glass units (of thermo-setting, polyester resin) are compression-molded and stoutly reinforced to afford maximum protection. All are fitted with a new ratchet type head gear which adjusts to size with the flick of the fingers. Headgear material (of high impact plastic) is smooth, easy to clean and unaffected by chemical reaction.

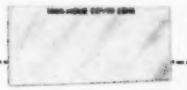
No. 51-8F-P14

NEW DESIGN ADVANTAGES

1. Lighter weight for more comfort.
2. A smoother and stronger shell.
3. Easier cleaning and sterilizing.
4. Non-warping moisture-proof construction.
5. Superior resistance to heat.

No. 53-8F-P14

No. 51-2F-P14



Enjoy real savings with Flood's

1000-HOUR COVER LENS

Outlasts 125 glass lenses. Reduces eye fatigue. Safer because shatter-proof.

No. 53-2F-P14

See Your Distributor or Write:

Flood Always FINEST QUALITY FAIRLY PRICED

FLOOD SAFETY PRODUCTS CO.

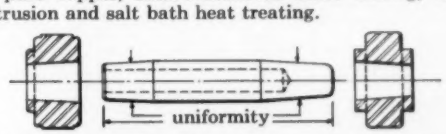
3037 WEST LAKE STREET, CHICAGO 12, ILLINOIS

TUFFALOY®

They Look different... and they Are!

The bright and shiny look of the new Tuffaloy spotwelding tips is due to a process that practically eliminates oxidation. More than that, it reflects the deep-down quality built into these tips and into all Tuffaloy products.

What you want in these tips is highest conductivity and resistance to deformation. Tuffaloy provides this by the most modern manufacturing methods, and by constant scientific quality control all the way: alloying of pure copper, semi-continuous billet casting, bar extrusion and salt bath heat treating.



And in converting this high-quality bar stock to welding tips, Tuffaloy insures conformity to all standard dimensions. Before shipment all tips must pass inspection by gage for uniformity in length, Morse taper, and the outline of the point.

Tuffaloy resistance welding alloy products are widely available through Airco and Tuffaloy representatives. Call on them for SPOTWELDING TIPS (Standard, 'Tuffcap', Cold-Bent, and Special), Holders and Adapters, BAR STOCK, FORGINGS, SEAM WELDING WHEELS, and all other welding alloy needs. Ask for Catalog and Price List.

AIRCO®

AIR REDUCTION SALES COMPANY

A Division of Air Reduction Co., Inc.

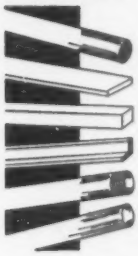
150 East 42nd Street, New York 17, N.Y.

For More Information Circle No. 67 on Reader Service Card.

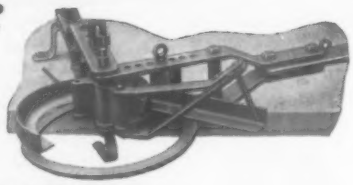
For More Information Circle No. 39 on Reader Service Card.

1 MAN + 1 BENDER

Bends all these:

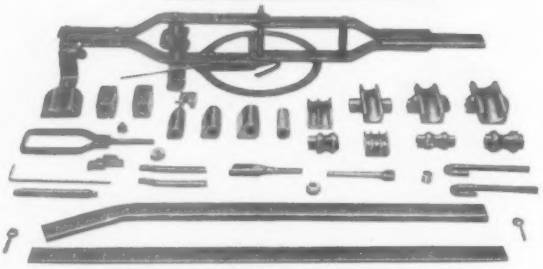


ROUNDS
FLATS
SQUARES
ANGLE IRON
PIPE
TUBING & CONDUIT



HOSSFELD
UNIVERSAL® IRON BENDER
35 Years Bending Experience

- Wrenchless, ready to use.
- Practical, quickly set up.
- Adaptable, replaces special equipment.
- Versatile, 143 different dies available.
- Dependable, a "must" for maintenance, limited production.
- Invaluable, optional equipment makes jobs easier.



BENDER SHOWN WITH REGULAR EQUIPMENT

FREE: WRITE FOR BULLETIN.

HOSSFELD MFG. CO.
436 W. THIRD STREET • WINONA, MINNESOTA

NEW! WELSH FACE SAVER

MODEL 6500
TROJAN
Patent Pending

ONE SIZE COMFORTABLY FITS EVERYONE!

Another First!

New Welsh "TROJAN" Face Shield features rugged, lightweight, polyethylene headgear with simple ratchet adjustment with positive lock . . . and green or clear acetate windows held securely to wide fibre spark guard by fibre band with three positive snap fasteners.

WELSH Willingly Worn By Workers Everywhere

WELSH MANUFACTURING COMPANY
3 Magnolia Street, Providence, R. I.

For More Information Circle No. 74 on Reader Service Card.

Magnetic Tape Tracer Welding System

A new magnetic tape tracer welding system that permits joining of metal parts having untrimmed, out-of-tolerance, straight line or contour weld line edges in a continuous automated welding operation has been developed by Expert Welding Machine Division, Expert Die and Tool Co. This system controls self-powered welding heads which automatically follow any welding contour with a high degree.

Machines built thus far have used the CO_2 process; however, the system is equally adaptable to any other arc welding process.

The system has been used for automated production welding operations on parts such as automotive wheels, frame side-rail (see photo) and frame crossmembers.

Circle No. 139 on Reader Service Card.

Squeeze-On Flux

Aircosil flux for silver brazing stainless steel, mild steel, copper, brass and a wide range of alloys, is now available from Air Reduction Sales Company in a new handy 12-oz. plastic squeeze bottle.

Users can now pinpoint flux application. The bottle top comes off for refilling with flux or thinning with water. Advantages: no brushes, no jars to break, no waste or skin contact, and evaporation is minimized.

Circle No. 140 on Reader Service Card.

New C-Clamp Spindles

Heat treated spindles are being used on 400 and 900 series C-clamps made by Wilton Tool Mfg. Co., Inc. The heat-treated spindles are stronger and will resist greater forces without bending or shearing. Heat treating also develops a high degree of corrosion resistance.

Circle No. 141 on Reader Service Card.

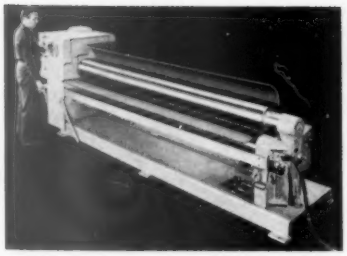


Plate Bending Rolls

Finger tip controls are said to give unprecedented ease of operation to the new 9- and 10-inch diameter plate bending rolls introduced by Niagara Machine & Tool Works. Developed to make quick work of turning out commercially true cylinders, these machines handle metal plate up to ¾-inches thick.

Complete, instant control over forward and reverse rotation of rolls is provided by a squirrel cage brake-type motor, momentary contact pushbuttons and oversize magnetic contactors. Rolls deliver full torque the instant buttons are pressed. A powerful brake stops the rolls instantly on release of either button, prevents drifting and provides close control for inching. Other pushbuttons control the raising or lowering of the power-adjusted rear roll for quick, easy positioning to the desired cylinder diameter.

Circle No. 142 on Reader Service Card.

Chain Hoists

A new line of differential-type chain hoists in ¼-, ½-, and 1-ton capacities is being marketed by Shaw-Box Crane & Hoist Division of Manning, Maxwell & Moore, Inc. Known as the "Budgit" Differential Chain Hoist, they are of simple design produced for use where efficiency is secondary to price.

Design features include: aluminum upper and lower yokes for minimum weight and greater strength; accurately machined holes assure perfect alignment of both hook and load sheave pins and reduce frictional drag, and a special steel load chain that has a rust- and corrosion-resistant blue-tempered finish.

Circle No. 143 on Reader Service Card.

Boiler Tube Stress Reliever

Falcon Equipment Company has announced a new style heater for stress relieving weld joints and repairs in high pressure steam boiler tubes.

The clamp-on type heater is designed to stress relieve tube diameters up to 2½" O.D. It has a capacity of 2¼" kw and will heat a 10-inch length to 1350°F.

The unit operates on 230 volts or 460 volts, single phase A.C. Also available for 115 volt A.C.

Circle No. 144 on Reader Service Card.

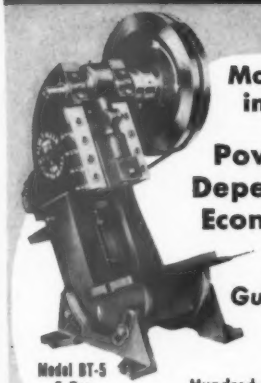
Silver Brazing Paste Alloy

Designed to eliminate separate application of brazing alloy and flux in automatic silver brazing is the ST series announced by Fusion Engineering. The paste alloy (in standard silver alloys) can effect labor savings up to 80% with special dispensing equipment; rejection rates are lowered.

Circle No. 145 on Reader Service Card.

more new products on next page

ALLEN'S
HEAVY DUTY PUNCH PRESSES



Moderate in Price

Powerful Dependable Economical

Fully Guaranteed

Model BT-5
5 Ton
$199.50
less motor—fob

Hundreds of different Model Combinations 1 to 12 ton Capacities

See your Supply Dealer or write for catalog giving complete information, specifications and prices on our line of Heavy Duty Punch Presses.

Thousands in use the World over

ALVA ALLEN INDUSTRIES
Dept. IW. Clinton, Missouri

Circle No. 6 on Reader Service Card.

NEW!

NOW IN 3 CURTAIN MATERIALS:

- ✓ 12 oz. DUCK — fire resistant.
- ✓ NEO-WELD — yellow neoprene-coated fiber glass. Gives greater protection and longer service.
- ✓ ALUMINIZED ASBESTOS CLOTH. Protects by reflection against radiant heat and flame — up to 1400° F.

Light in weight, yet sturdy and rust-proof. Assembles in 5 minutes — no threads. Folds flat. Dozens of uses — welding curtain, machine screen, grinding shield, wall curtain, etc. Available in all sizes. Ask your dealer or write us.

16 PAGE CATALOG
Complete line of work gloves, welding gloves and safety clothing.

Special Products Division
SINGER GLOVE MFG. CO.
860 W. Weed St.,
CHICAGO 22, ILL.

SEE OUR AD IN WELDING DIRECTORY

Circle No. 59 on Reader Service Card.

Just You TRY to *Break a*

THERMO *Spiral*

TIP CLEANER

The exclusive, non-breakable advantage of THERMO TIP cleaners didn't just happen—No Sir. This feature resulted after 10 years research, and experience. That's why we say no other type or make can match a THERMO, and the best way to prove that statement is to send for a FREE THERMO Spiral Tip Cleaner and put it to every test—as to its cleaning efficiency and long lasting performances. Yes, just TRY to break it —then you'll know why—

All progressive Welding Supply dealers Recommend THERMO TIP CLEANERS

THERMACOTE COMPANY
1085 DeLacey Ave. PASADENA, CALIFORNIA

Circle No. 64 on Reader Service Card.

Portable Welder

"Porta Weld" is the name of a new semi-automatic welder developed for hard surfacing applications by Hensley Equipment Co., Inc. The manufacturer states the unit combines simplicity with light-weight portability.

Dual reels and power drive assemblies are mounted simply on a 16- by 18-inch base. It is designed to accommodate both standard 12-inch reels and pay-off bulk spooling in 3- and 4-inch widths, 12-inches in diameter. All semi-automatic hardfacing alloys can be handled in 3/32-, 7/64 and ⅛-inch diameters.

Circle No. 146 on Reader Service Card.

Seam Welding Salvages Scrap

A patented foil butt seam welding machine marketed by Precision Welder and Flexopress Corporation can be used to salvage scrap metal. The machine welds odd-shaped off-fall into useable-size sheets. According to the manufacturer, the new machine makes smooth, non-overlapping seam welds of dense structure and high strengths —at high speeds. It can be used for mild, low carbon, high carbon and stainless steels. It has been used to weld .078-inch stock at 3 to 24 feet per minute.

In the process a thin strip of foil is introduced on each side of the butt seam to be welded. This foil acts as a bridge to distribute welding current to both sheets; it also prevents too-rapid withdrawal of heat from the joint area. Foil strip offers added electrical resistance and helps contain the molten weld nugget while it grows in area and cools. Sheets are generally clamped.

Circle No. 147 on Reader Service Card.

Silver Solder Flux

A new low temperature flux with a powerful scavenging action has been announced by the Farrel-loy Company.

The Ag flux spreads the solder and increases tinning coverage to save costly silver on stainless steel and non-ferrous jobs. Clean, non-porous joints result. The flux is effective because of its oxide breaking action.

Circle No. 148 on Reader Service Card.

Industrial TV

A versatile and complete new line of closed-circuit TV makes possible remote viewing of an action or process otherwise inaccessible or hazardous. The basic system consists of new and improved camera, monitor and control unit.

The camera features an entirely electronic light compensator (no

Now! THE NEW INEXPENSIVE WAY TO SOLVE YOUR SEVERE ABRASION PROBLEMS!

SS HC HARD PLATE

Heat Treated High Carbon Steel

- Brinell hardness 230/250.
- Tensile strength 110,000 psi.
- Easily welded with L. H. electrodes.
- Machinable with high-speed tools.
- Easily fabricated in the field.
- Lasts from 3 to 10 times longer than mild steel.

APPLICATIONS: • Chutes • Hoppers • Spouts • Truck Beds • Buckets • Conveyors • Loaders • Scraper Blades • Screens, etc.

SEE YOUR WELDING SUPPLY DISTRIBUTOR — HE'S A GOOD MAN TO KNOW.

WRITE FOR COMPLETE DETAILS AND NEAREST DISTRIBUTOR

MEMBER NATIONAL WELDING SUPPLY ASSOCIATION

PRODUCT OF STULZ-SICKLES CO

929 JULIA ST. • ELIZABETH, N. J.

For More Information Circle No. 60 on Reader Service Card.

WOOD HANDLE OR STEEL HANDLE— Atlas Gives You The Best!

For welders who prefer wood handle Tomahawks, Atlas W-H models are tops. "Tough" induction hardened heads, long, thin chipping blades assure maximum life.

Write for Atlas Catalog.

Atlas Welding Accessories Inc.

707 E. Lewiston Ave. • Ferndale 20 (Detroit) Mich.

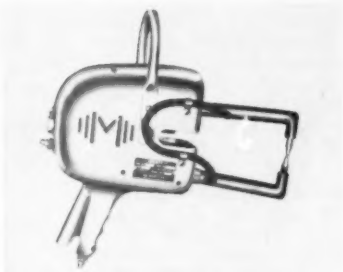
Circle No. 16 on Reader Service Card.

moving parts) which instantly and automatically adjusts to compensate for light changes over a practical range eight times as great as normally covered by lens stops.

Accessories include remote controls for optical focus, lens turret, zoom, iris, pan and tilt, as well as explosion-proof and weather-proof housings, distribution amplifiers and multiple camera switches.

Manufacturer is Industrial Products Division, International Tel. and Tel. Corp.

Circle No. 149 on Reader Service Card.



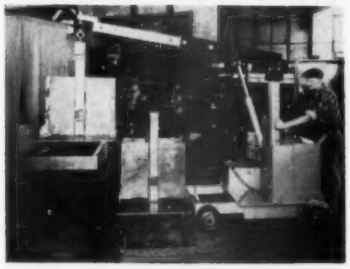
Portable Spot Welder

A new-type spot welder, designed for portable or pedestral operation, has been introduced by the Merit Company.

It has an automatic electronic timer and contactor to guarantee consistent welds, welding capacity up to $\frac{3}{16}$-inch combined thickness, on a wide variety of metals.

The unit is available in air cooled or water cooled models. It weighs 28 pounds.

Circle No. 150 on Reader Service Card.



Mobile Floor Crane

A counterbalanced mobile floor crane introduced by Vanguard Engineering Co. has an adjustable boom with the hook reaching as far as 48-inches beyond the front edge of the truck. The Aero-Crane is available in several models ranging in capacity from 1000 lbs. to 3000 lbs. at 48-inches extension. All models are available with a fork attachment and an extra long boom, 72-inches if desired.

Circle No. 151 on Reader Service Card.

Quick Tool Switch

Stow Manufacturing Company has introduced a quick disconnect handpiece for use on flexible shafts. In seconds, a wire brush can be exchanged for a grinding wheel (or other accessory) to speed up production. Just pull one off and snap on the next.

Handpiece has high speed ball bearings and is held in place by a spring and ball-lock mechanism in a special coupling that is attached to Stow's standard tool shafts.

Circle No. 152 on Reader Service Card.

Squeeze Flux

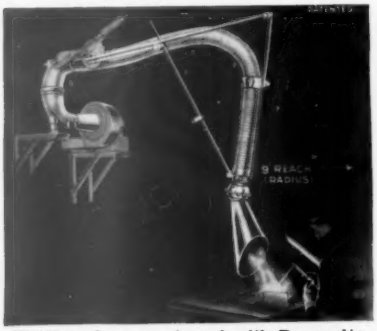
A new plastic dispenser has been announced by the American Products Corp. for their Xcel-Flux (used with low-temperature alloys for brazing ferrous and nonferrous metals.)

Pin-point the flux exactly where needed with the plastic spout, or apply it with the built-in brush; it's always fluid in the refillable bottle.

Circle No. 153 on Reader Service Card.

more new products on page 76

Remove Welding Fumes at the Source... with RUEMELIN FUME COLLECTOR



Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed.

Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle.

WRITE FOR DETAILED INFORMATION

RUEMELIN MFG. CO.

3891 N. PALMER STREET • MILWAUKEE 12, WIS., U.S.A.

Mfrs. & Engineers • Sand Blast & Dust Collecting Equipment

Circle No. 56 on Reader Service Card.

REDUCE WELDING COSTS
BY PROPER CARE OF
ARC WELDING CIRCUITS
AND REMEMBER

IT'S EASY when you BUY HI-AMP

ELECTRODE HOLDERS

FOR YOUR WELDING JOB — WHETHER IT BE LARGE OR SMALL — INSIST ON HI-AMP. THEN YOU'LL BE ASSURED OF GETTING THE BEST MONEY CAN BUY AT THE LOWEST COST.

LENCO, INC. Jackson, Mo.

For More Information Circle No. 43 on Reader Service Card.

Welding Helmet And Sound Protector

Developed by the American Optical Company is a new welding helmet-sound protector for use by operators working in noisy areas.

The unit effectively protects against high and low frequency noises. Ear domes swivel to fit any shape head. The ear puffs are easily removed and replaced for sterilization. Conversations and signals are audible.

Circle No. 154 on Reader Service Card.

New Marking Material

A new permanent marking material for use on bare metal is announced by Phillips Products, Inc. Penapaint is placed on bare metal with a brush, spray or stencil either before or during fabrication.

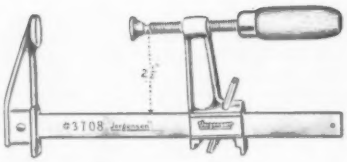
The marking cannot be washed or rubbed off and is permanently visible. When the marking has served its purpose, further penetrating action can be quickly stopped at any stage with Penapaint Mask. This is a specially compounded material through which Penapaint will not penetrate.

Circle No. 155 on Reader Service Card.

Grinding and Finishing Expanding Wheel

A new type of grinding and polishing wheel that has rubber expanders and uses coated abrasive bands has been announced by Merimac Products, Inc. Composed of metal hubs to which rubber is molded, the wheels eliminate the need for backstand-idlers. The abrasive band is fitted loosely around the wheel while at rest. When the wheel is at operating speed, centrifugal force makes it expand and grip the band.

Circle No. 156 on Reader Service Card.



Bar Clamp

A light - weight, instant - acting bar clamp introduced by Adjustable Clamp Co. is said to be ideal for light fabricating, assembly and repair work. Featuring new "extended" clutch-disc design, Style No. 37 is instantly adjustable within its capacity range, operates faster than conventional "C" clamps and can be used in close quarters.

Reach is 2½-inches from edge of bar to centerline of screw. Clutch-discs are reversible, or easily replaced if necessary.

Circle No. 157 on Reader Service Card.

X-Ray Spectrograph

A new 100 KV X-ray spectrograph, operating at twice the potential formerly available and incorporating many design improvements for the rapid qualitative and quantitative analysis for elements in liquids, powders and solids, is available from the Instruments Division, Philips Electronics, Inc.

The new instrument analyzes

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- Systems have been approved for Government Health Depts. in U. S. & Canada.
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Circle No. 49 on Reader Service Card.

metals, alloys, minerals, ores, chemical mixtures and compounds; it covers a range of 87 elements in the atomic scale, extending from magnesium (number 12) to californium (number 98). Specimen holders are made to accommodate solid, liquid or powder specimens up to 2-inches in diameter; thickness can vary from 1/16-inch to 1-inch.

The spectrograph consists of two units: A main chassis assembly and an electronic circuit panel cabinet.

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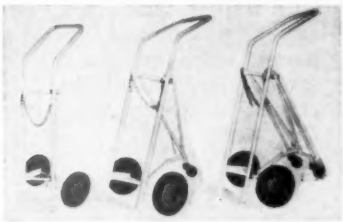

Oxygen Handling Trucks

Three new hand trucks for handling medical oxygen cylinders is announced by the Harper Steel & Supply Company. The all-welded design of light weight steel tubing gives the trucks great strength, and makes them light in weight. All models have sturdy ball bearing wheels for easy rolling.

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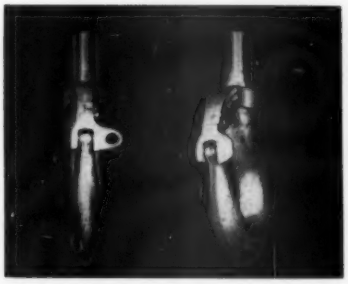

Safety Hoist Hook Gate

The safety hoist hook gate is a new locking mechanism designed for large hoist hooks by E. D. Bullard Co. The lock automatically opens and drops closed upon contact with the hook's tip. It is equipped with a ring to permit remote operation when the hook is being used over intense heat or chemicals. The gate may be opened with a reach rod.

Circle No. 160 on Reader Service Card.

Combination AC Welder And Power Generator

A new combination AC power supply and 200 amp AC welder has been announced by The Lincoln Electric Company. The machine serves as 5 KVA power supply when commercial power fails or where commercial power is not available. The unit will start and run motors as large as 3 horsepower.

The "Weldanpower" unit provides 115 or 230 volt, 60 cycle, AC single phase power. It is rated 5 KVA, continuous duty. Maximum continuous current at 230 volts is 18.2 amperes.

Circle No. 161 on Reader Service Card.

Ceramic Tooling

A new product of Duramic Products, Inc. is Sur-Braze Grade S-2, a simply cast ceramic tooling that costs less than 20% as much as alloy steel tooling and weighs only 1/3 as much.

S-2 is ideal for brazing, soldering, heat treating, or welding fixture tooling, because it will take 3000°F temperatures; it assures less warpage and closer dimensions than metallic fixtures.

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No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

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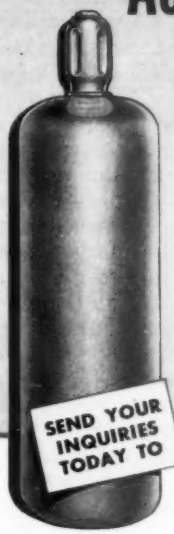

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Circle No. 66 on Reader Service Card.

Coyne Builds New Western Plant

A modern, 44,000 square foot building is scheduled for completion this month by Coyne Cylinder Co. Located in the South San Francisco-Lindenville Industrial Park section, the building will house complete acetylene cylinder manufacturing facilities including experimental and quality controls laboratories.

Burdett Oxygen Builds Detroit Plant

The new Detroit, Michigan, plant of Burdett Oxygen Company, Cleveland, Ohio, is scheduled for completion sometime this month. Located at 13500 Sanders Road in Detroit, the plant will manufacture industrial and medical gases and will stock a complete line of welding, cutting and safety equipment.

Eutectic Announces Expansion Program

Eutectic Welding Alloys Corp., Flushing, New York, will spend over one-million dollars in 1959 to expand its research development and technical service facilities. Announcement was made at a recent press conference by Fred F. Roehll, vice president.

Roehll said that Eutectic will open at least four new Warehouse-Service Centers in 1959 to add to the chain of 11 such centers now operating in principal United States and Canadian cities. These centers are the local distribution point for the company's line of 150 different alloys, fluxes and chemical aids for welding.

The first of these Warehouse-Service Centers opened last month in Boston. This will be followed by others in Pittsburgh, Baltimore, Philadelphia and Vancouver, B.C. Several other cities are also under consideration.

A.R.O. Completes New French Factory

A modern, new factory built at Chateau-du-Loir, France, tops off the success story of A.R.O., manufacturer of portable spot welding guns. Founded in 1949, the firm has sold 30,000 guns in less than 10 years, increased its capital from 1,000,000 to 50,000,000 million francs and has become the owner of two factories.

The company, which makes 10 different types of guns including a twin-spot type, is the parent company of ARO Spot Welder Division, Guthery Machine Tool Corp., Long Island City, N.Y.

N.W.S.A. Announces Convention Details

The 15th Annual Convention of the National Welding Supply Association will be held at the Fairmont Hotel, San Francisco, Monday, Tuesday and Wednesday, May 4, 5 and 6. The Association's Convention Committee headed by Norman H. Balaam is completing arrangements which will be announced in full in the April issue of INDUSTRY & WELDING.

Distributor Appointments

Alloy Rods Company, York, Penna.: Industrial Welding Supplies, Inc., Charleston, S.C.

National Cylinder Gas Division of Chemetron Corp., Chicago, Illinois: Avon National Oxygen Co., Springfield, Ohio; Avon Oxygen and Supply Co., Lima, Ohio; M. and I. Supply Co., Muskegon, Mich., and Hughes Auto Supply, Salem, Indiana.

Harnischfeger Corporation, Milwaukee, Wisconsin: Compressed Gas Sales Co., Wichita Falls, Texas; Compressed Gas, Inc., Abilene, Texas, and Four R. Industrial Supply Co., Borger and Pampa, Texas; Sommerfeld Welding Supply Co., Oshkosh, Wisconsin.

World Electric Co., Cleveland, Ohio: Hobart Welder Sales & Service, Buffalo, New York.

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Yes, actually a BOYCE Centering Head replaces

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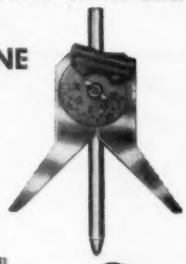

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DIAL SET LEVEL

Weighs only 9 ozs. Pocket size.

Y type head accurately machined with tangents and tips for centering and aligning. Dial Set Level in graduations of 2½ and 10 degree markings. Punch of Drill Rod with hardened point—insuring long service. Send for complete description.

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BOYCE CENTERING HEAD

REBUILD WORN TRACTOR SHOES

With Bulldog Grip Lugs

Bulldog Tractor Grip-Lugs can rebuild the grouser shoes of track-laying or crawler-type equipment—at a fraction of the cost of new replacement parts. Equipment can be "re-lugged" without dismantling—saving hours of valuable downtime and labor.

Grip-Lugs are easily welded to the worn shoe. Made of special work-hardening steel, they become tougher and harder with use—usually outwear the original grouser.

For all track-laying and crawler-type equipment including Caterpillar D9's and Euclid TC-12's.

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PIPE CALCULATOR

Perfected "Dial" calculator 5½" in diameter consisting of instant calculations of cut back of miter, saddle "y" branches on pipe sizes 2" to 48". Guaranteed accurate. Price $3.00.

Dial-A-Cut, P.O. Box 1532, Savannah, Ga.

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ASSISTANT PRODUCTION SUPT.

Preferably a graduate mechanical or welding engineer with 5-10 years welding fabrication shop experience in miscellaneous heavy steel, aluminum and stainless steel weldments. Experience in modern techniques and applications desired. Ability to organize and operate efficient shop very important. A large growing company offering an excellent future. Located in the middle west. Write Box 2159, INDUSTRY & WELDING Magazine, 812 Huron Road, Cleveland 15, Ohio.

Report From Arc Welding Section of N.E.M.A.

About 20 members of the Arc Welding Section of the National Electrical Manufacturers Association met recently in Chicago.

J. E. Norcross reported for the federal and military specifications committee covering arc welding electrodes and filler wire. He advised that military specification MILE-19322 had been approved. He also advised that the Navy Department had alerted his committee to study a problem in which certain low hydrogen electrodes were losing their identity through destruction of the color coating when they were rebaked.

The committee for the development of an arc welding booklet, under the chairmanship of R. D. Thomas, Sr., Arcos Corp., submitted text and photographs of the booklet and an initial printing was authorized.

Welding Engineer

The Armour Research Foundation has an opening for an experienced welding engineer. Applicants should have several years of experience in welding and brazing research with at least a B.S. degree in Welding or Metallurgy.

The Foundation is located on the campus of the Illinois Institute of Technology and encourages graduate engineering study through its education program providing tuition free graduate study, in addition to offering competitive salaries and liberal benefits including generous relocation allowance and vacation program.

Please send complete resume to:

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Armour Research Foundation
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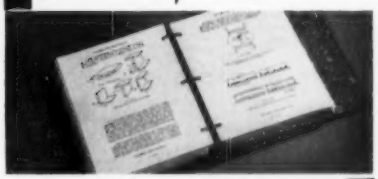

Over 450 pages, 8½" x 11", packed with Welding know-how (in a gold embossed leatherette looseleaf binder).

"Welding Fundamental Principles and Practices" provides MANAGEMENT with a proven method of training personnel to specify, supervise and inspect welding. MEN—you take this training in your own home at hours you, yourself, set. On successful completion you are awarded a handsome engrossed certificate.

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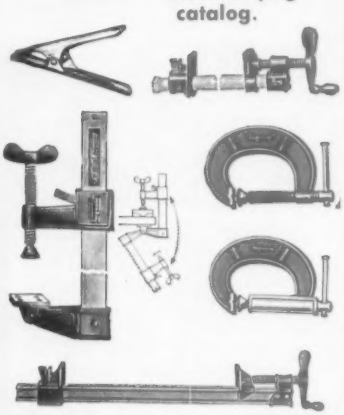

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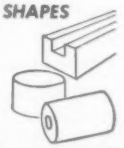

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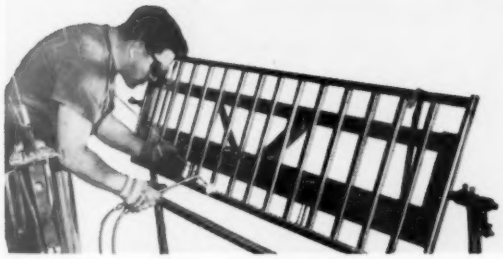

WELDING CLINIC

J. Imperati and R. F. Pulver, Welding Engineers
The American Brass Company, Waterbury, Conn.

Braze Welding of Cast Iron

There are two major obstacles to successful repair welding of cast iron: 1. low-strength and poor ductility of cast-iron weld metal, 2. embrittlement and hardening produced by rapid cooling from fusion-welding temperatures.

Oxyacetylene fusion welds with cast-iron rods have such very low strength and ductility that they often crack under the stresses imposed during welding and cooling. If they survive these hazards, they are likely to fail when subjected to the service stresses that caused the original failures.

Arc welding, because of steep temperature gradients between weld and base metal, is likely to embrittle and harden both weld and adjacent base metal. Here, too, failure may occur during welding and cooling, or later in service. It is usually necessary to resort to carefully controlled schedules of preheating, peening, and post-heating, often with high-cost alloy filler metal, to avoid the twin evils of embrittlement and hardening.

Oxyacetylene braze welding is an excellent solution to the problem for two reasons. With the low temperatures required, there is no rapid cooling from high temperatures and therefore no embrittlement. Excellent ductility and high strength of the weld metal deposited by Tobin Bronze*-481, Anaconda-997 (Low Fuming) Bronze, and Nickel Silver-828, permit yielding while the repairs are being made and after they are returned to service, and the danger of failure is practically eliminated.

The braze-welding operation itself is virtually foolproof because the molten bronze automatically "tins out" or spreads over the joint surfaces when the correct temperature is reached. Since the base metal is not melted, control of the weld metal is very easy and braze welding is readily done in all positions.

ADVANTAGES OF BRAZE WELDING WITH ANACONDA WELDING RODS ARE:

1. Economy in welding time and gas consumption.

2. Development of low residual stresses with less distortion and less tendency to crack.

3. No embrittlement, and complete machinability of the weld areas.

4. Minimum delay in returning the repaired parts to service.

DETAILED INFORMATION AVAILABLE

Detailed suggestions on the methods of chipping grooves, removing oil, positioning the work, and preheating are given in Publication B-13, which gives full information on Anaconda Welding Rods, discusses procedures for welding with copper and copper alloys in a wide variety of applications.

EXTENSIVE BRAZE-WELDING REPAIRS on the frame of this big steam hammer used 1850 lb. of Tobin Bronze Welding Rod — saved six months' production time, for one-fifth of replacement cost.

These are some of the subjects covered: Copper-Alloy Welding Rods in steel sheet metal work, brazing and soldering, resistance welding, surfacing, welding copper alloys to steel, arc welding of copper and copper alloys.

For information on special problems—or for a copy of Publication B-13—write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 58102

WELDING ROD	APPROX. COMPOSITION, %	APPROX. MELTING POINT	
		Deg. C	Deg. F.
Tobin Bronze-481	59 copper, 40.40 zinc, 0.60 tin	885	1625
Anaconda-997 (Low Fuming) Bronze	57.80 copper, 40.27 zinc, 0.95 tin, 0.85 iron, 0.10 silicon and 0.03 manganese	870	1598
Nickel Silver-828	48.58 copper, 41 zinc, 10.25 nickel, 0.15 silicon, 0.02 phosphorus	930	1706

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